The NUBASE2020 evaluation of nuclear physics properties *

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Abstract: The NUBASE2020 evaluation contains the recommended values of the main nuclear physics properties for all nuclei in their ground and excited, isomeric ($T_{1/2}\geq$100 ns) states. It encompasses all experimental data published in primary (journal articles) and secondary (mainly laboratory reports and conference proceedings) references, together with the corresponding bibliographical information. In cases where no experimental data were available for a particular nuclide, trends in the behavior of specific properties in neighboring nuclei were examined and estimated values are proposed. Evaluation procedures and policies that were used during the development of this evaluated nuclear data library are presented, together with a detailed table of recommended values and their uncertainties.

Keywords: NUBASE2020 evaluation, nuclear properties, atomic masses, isomers, excitation energy of isomers, spin and parity, half-life, year of discovery, decay modes

DOI: 10.1088/1674-1137/abddae

1 Introduction

NUBASE2020 is an evaluated nuclear data library that contains the recommended values of the main nuclear physics properties: masses, excitation energies (for excited isomers), half-lives, spins and parities and decay modes, and their intensities, for all known nuclei in their ground and excited, isomeric ($T_{1/2}\geq$100 ns) states. It also includes information for yet unobserved nuclides that is based on systematic trends of nuclear properties in neighboring nuclei. The present publication includes updated results for these properties, which were reported in previous versions of this library [1–4]. The recommended data are presented in Table I.

The information included in NUBASE2020 represents the fundamental building blocks of the modern nuclear physics, and specifically of the nuclear structure and nuclear astrophysics research. One of the main applications of NUBASE2020 is the "Atomic Mass Evaluation" (AME2020 - the second and third articles included in this issue) where it is imperative to have an unambiguous identification of all states involved in a particular decay, reaction or mass-spectrometry measurement. This is the main reason for coupling the two evaluations together in the present issue. Furthermore, with the advances of modern mass-spectrometry techniques and the availability of intense stable and rare-isotope beams, a large number of short-lived nuclei can be produced in a single experiment and their masses can be measured with a high precision. Thus, NUBASE2020 can be a trusted source of information in future mass measurements, where an unambiguous identification of specific nuclides in complex mass-spectrometry data would be required.

NUBASE2020 also serves nuclear structure research, astrophysics network calculations, and theoretical studies of nuclear properties, where complete, up-to-date and reliable data for all known nuclei are needed. It can be particularly useful in present and future studies of nuclei and their properties at the major nuclear physics facilities around the world, such as FAIR, ISOLDE and SPIRAL2 (Europe), ATLAS and FRIB (USA), HIAF (China), RIBF at RIKEN (Japan), ISAC and ARIEL (Canada), and elsewhere.

Furthermore, the evaluated data included in NUBASE2020 are a valuable source of information for specialists in a number of applied nuclear fields, such as safeguards, nuclear forensics, reactor engineering, waste management, material analysis, medical diagnostics and radiotherapy, and elsewhere, where one needs to access reliable

Received 19 January 2021, Accepted 20 January 2021, Published online 5 March 2021
**This work has been undertaken with the endorsement of the IUPAP Commission on Symbols, Units, Nomenclature, Atomic Masses and Fundamental Constants (C2).
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nuclear physics information for any nuclide.

The recommended data included in NUBASE2020 fulfill several user-demanded requirements, namely that they are: a) *complete* – include all measured quantities and their uncertainties, b) *up-to-date* – include results from all recent publications, c) *credible and reliable* – identify and resolve contradictory results that exist in the scientific literature, as well as in other nuclear physics databases, d) *properly referenced* – provide comprehensive bibliographical information for all included properties.

In general, NUBASE2020 was updated via three different routes: a) directly from the literature by compiling and evaluating data that were published in *primary* (nuclear physics journals) and *secondary* (abstracts, conference proceedings, private communications, theses, arXiv publications and laboratory reports) references; b) by consulting, and when merited by adopting, recommendations made in topical evaluations that include nuclear properties covered by NUBASE (see the text for details); c) by consulting, and when merited by adopting, recommended values from the "Evaluated Nuclear Structure Data File" (ENSDF) database [5] .

It is important to note that data presented in ENSDF and in other topical evaluations were carefully examined, and only results that were found to be *valid* and *up-to-date* were considered. In general, the content of ENSDF is very large, since it encompasses the complex nuclear structure and decay properties for all nuclei and all excited nuclear states. Maintenance of this library requires an enormous effort and it is not surprising that occasionally some older data are missing or misrepresented, and that some recent data are not included. When such cases were identified, the data were re-evaluated and the corresponding conclusions were added as comments in Table I.

The content of NUBASE2020, together with the adopted policies that were used during the development of this nuclear physics data library, is described below. All experimental data available to the authors by October 30, 2020 were considered.

2 Content of NUBASE2020

The NUBASE2020 evaluation contains recommended properties for the ground state of 3340 nuclides and for 1938 excited isomeric ($T_{1/2}\geq$100 ns) states, derived from all available experimental data. It also includes information for yet unobserved nuclei (218 in their ground state and 45 excited isomers) whose properties were estimated by following the systematic trends in neighboring nuclei (TNN, see section 3.1).

For each nuclide and for each state (ground or isomeric), the following properties were compiled and, when necessary, evaluated: mass excess, excitation energy of the excited isomeric state, half-life, spin and parity, decay modes and their intensities, isotopic abundance (for stable nuclides), year of discovery and the corresponding bibliographical information for all experimental values of the above items.

2.1 Mass excess

In general, the knowledge of atomic masses can provide valuable information on the lifetimes of nuclear states and their decay modes, and in particular on the β-delayed particle decay probabilities for nuclei far from the line of stability.

The mass-excess values and their uncertainties that are presented in Table I were adopted from the latest edition of the Atomic Mass Evaluation, AME2020, as described in the second and third articles of the present issue. Figure 1 displays the uncertainties of the mass-excess values as a function of N and Z.

2.2 Isomers

Nuclear isomers are excited, intrinsic (single-particle in nature) states with lifetimes ranging from nanoseconds (or even shorter) to years. There are several recent compilations and review articles, where the physics of nuclear isomers was discussed in detail and the reader is referred to Refs. [6, 7] and references therein.

Following the NUBASE2003 publication [2], the present evaluation includes isomeric states with half-lives longer than 100 ns. Although this limit is somewhat arbitrary, the main reason for this choice was to include all short-lived isomers that can be directly produced at the present and future accelerator beam facilities and that can survive the time-of-flight path of the employed recoil mass separator, and as a consequence, their decay properties and/or masses can be directly measured.

Figure 2 shows a compilation of all such known isomers as a function of N and Z.

Isomers are listed in Table I in the order of increasing excitation energy and they are identified by the letters '*m*', '*n*', '*p*', '*q*', or '*r*' which are appended to the nuclide name, e.g. ^{90}Nb for the ground state, ^{90}Nb^{m} for the first excited isomer, ^{90}Nb^{n}, ^{90}Nb^{p}, ^{90}Nb^{q}, and ^{90}Nb^{r} for the second, third, fourth and fifth ones, respectively. In four cases, namely ^{98}Y, ^{174}Lu, ^{179}Ta and ^{214}Ra, a sixth isomer is presented and they were labeled with the letter '*x*' (see the Explanation of Table I for details).

The excitation energy of an isomeric states is determined by different experimental methods, which are generally attributed to the category of either *internal* or *external* relations. A typical *internal* relation involves the γ-ray energy, or the energies of a cascade of γ rays, associated with the isomer decay. The most-accurate values for the excitation energies of isomers that are deduced by this approach can be determined by a least-squares fit to the energies of all γ rays observed along the decay path of a particular isomer. In cases where *internal* relations cannot be established, connections to other nuclides (*external* relations) can be used to deduce the mass difference (excitation energy) between the ground state and isomers, and the excitation energies are taken from AME2020.

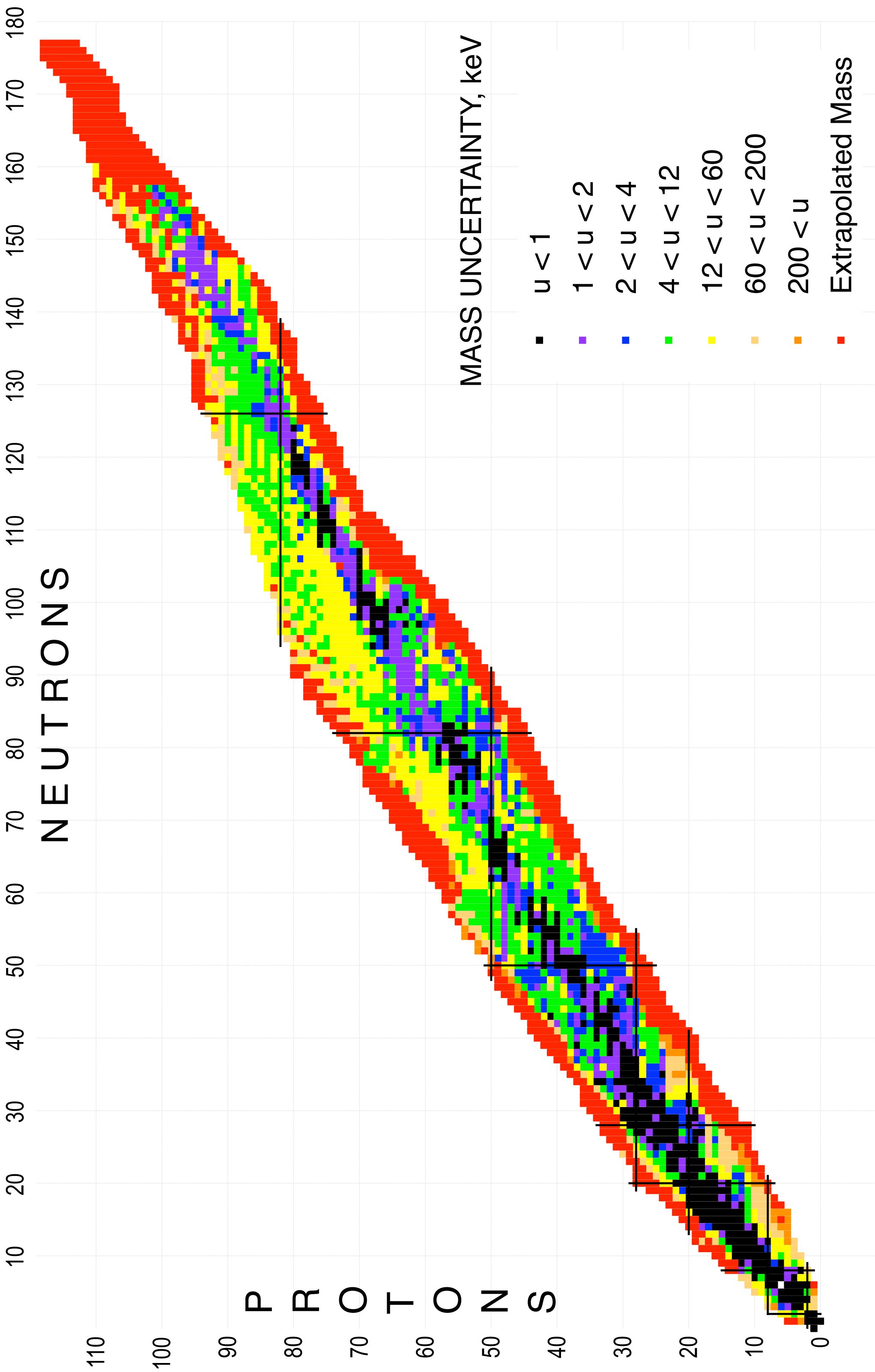

Fig. 1. Nuclear chart displaying the mass-excess uncertainties for all nuclei in their ground state.

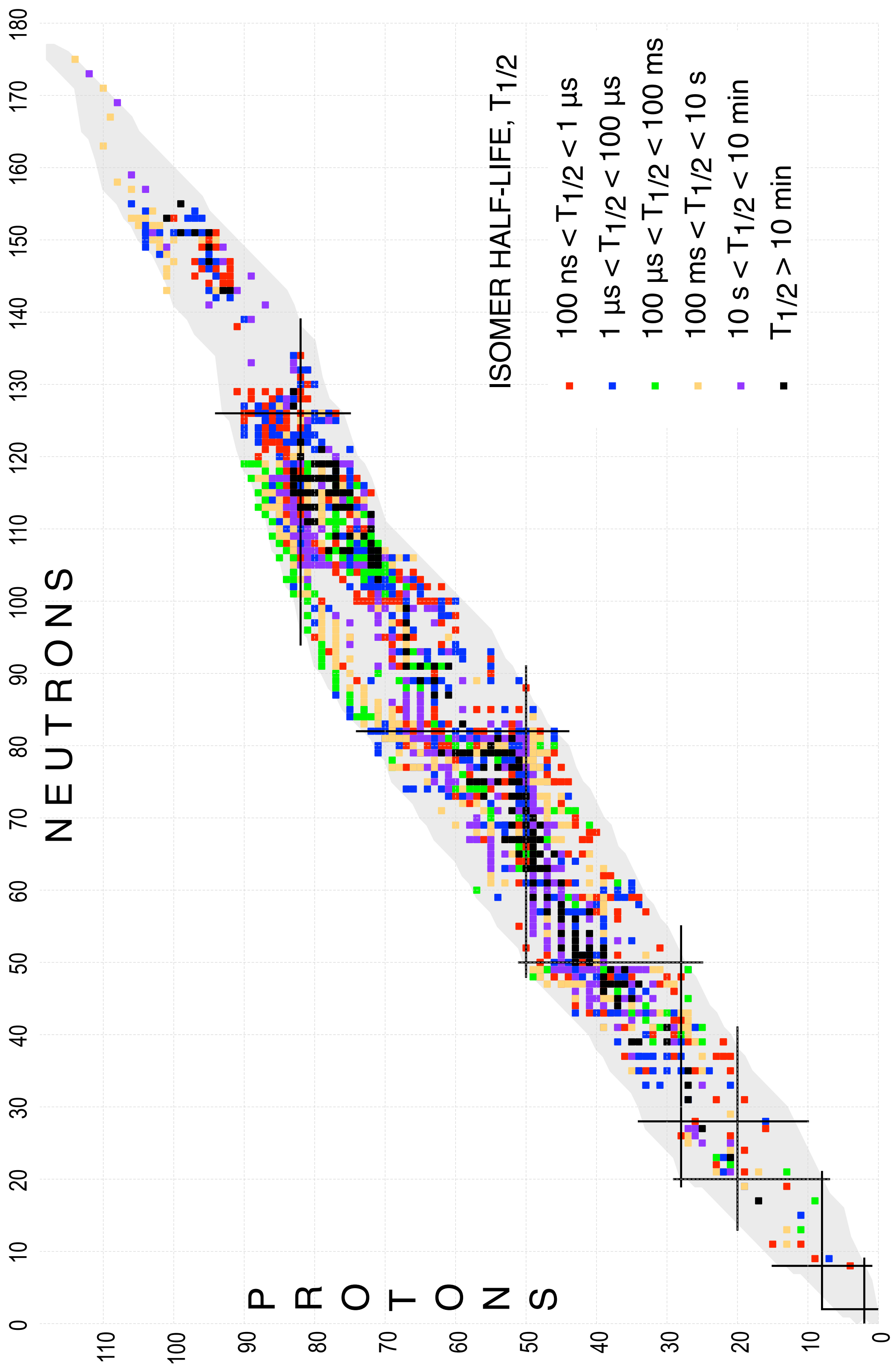

Fig. 2. Nuclear chart displaying isomeric states with $T_{1/2}\geq 100$ ns. For a given isotope where multiple isomers exist, only the longest-lived state is plotted.

The method used to establish the *external* relation for a particular isomer (the origin) is indicated by a two-letter code in Table I, next to the isomer excitation energy (see the Explanation of Table I for details). For *internal* relations, the origin field is left blank and the numerical values are taken either from ENSDF or from literature updates, where a least-squares fit to the measured γ-ray energies was performed, whenever possible.

There are also cases where the energy difference between the isomer and the ground state can be obtained by both the *internal* and one, or more, *external* relations with comparable accuracies. In such cases, the excitation energy of the isomer is taken from AME2020. For example, the mass of ^{178}Lu^m is determined in AME2020 at 66% from E_x(IT)=120(3) keV [1993Bu02] and at 34% from ^{176}Lu(t,p)^{178}Lu^m=4482(5) keV [1981Gi01], resulting in an adjusted excitation energy of 123.8(2.6) keV for the isomer.

In contrast to ENSDF, where the isomer excitation energies may not be quantified and are often given as floating levels with '+X', '+Y', etc., estimated values are always provided in NUBASE2020, based on theoretical considerations or TNN. In such cases, the reported excitation energies are considered as a non-experimental quantity and the values are flagged with the symbol '#'.

When the existence of an isomer is uncertain and it is still under discussion, it is flagged with 'EU' ("Existence Uncertain") in the origin field. A comment is usually added to indicate why the existence of this state is questioned or where this issue is discussed in more detail. Eleven isomers, namely ^{138}Pm^m, ^{142}Nd^m, ^{144}Cs^n, ^{152}Pm^n, ^{156}Tm^m, ^{162}Lu^n, ^{174}W^m, ^{174}W^n, ^{185}Bi^n, ^{190}Tl^n, and ^{273}Ds^m are treated in this way in the present evaluation. Nevertheless, the mass excess and excitation energy values are given for all of them, except for ^{138}Pm^m, ^{142}Nd^m, ^{144}Cs^n, ^{152}Pm^n, ^{174}W^m, ^{174}W^n, and ^{190}Tl^n, where the existence is strongly doubted.

When an isomer was initially reported as "discovered", but later this was proven to be an error, such a case is flagged with 'RN' ("Reported Non-existent") in the origin field. Nine isomers, namely ^{76}Cu^m, ^{84}Ga^m, ^{84}As^m, ^{85}Nb^n, ^{86}Nb^n, ^{117}La^m, ^{181}Pb^m, ^{196}Pb^m, and ^{197}Bi^n are treated in this way and no mass excess or excitation energy values are given. Similarly to the 'EU' cases, a "non-exist" label is also added. The use of the two flags, 'EU' and 'RN', was extended to cases where the discovery of a nuclide is questioned (e.g. ^{260}Fm or ^{289}Lv or ^{293}Og). However, an estimate for the ground state mass, derived from Trends from the Mass Surface (TMS), is always given in AME2020 and NUBASE2020.

Sometimes, upper and lower limits are known for the excitation energy of the isomeric state. Such cases are treated with uniform probability distribution, as explained in section 3.2. For example, there is solid experimental evidence [1974De47] that the excitation energy of the ^{162}Tm^m isomer is between the 66.9 keV and 192.0 keV levels and this information is presented (after rounding) in Table I as $E_x =$ 130(40) keV.

When it is not clear which state is the ground state and which one is the isomer, the flag '$*$' is added in Table I. Similarly, when the uncertainty of the isomer excitation energy, ΔE_x, is relatively large compared to E_x, e.g. $\Delta E_x > E_x/2$, the assignment of the level as a ground or isomeric state is also considered to be uncertain and it is flagged with the symbol '$*$', as well.

Based on new experimental mass information, the ordering of several ground and excited isomeric states was reversed in the present work, when compared to the recommendations in ENSDF, and such cases are flagged with the symbol '&' in Table I. In a few other instances, evidence was found for a state that is located below the adopted in ENSDF ground state and such results were also flagged with the symbol '&' in Table I. It is worth noting that because of the coupling between NUBASE2020 and AME2020 all changes in the ordering of nuclear levels are firmly established and synchronized.

2.2.1 Isobaric analog states

NUBASE2020 contains information for 205 Isobaric Analog States (IAS), which are labeled in Table I with the isospin multiplet value, T. Their excitation energies were determined via either the "*internal*" or "*external*" relation. The IAS nuclides are generally marked with the i or j superscripts, except for eight excited isomers, ^{16}N^m, ^{26}Al^m, ^{34}Cl^m, ^{38}K^m, ^{46}V^m, ^{50}Mn^m, ^{54}Co^m, and ^{70}Br^m. The isospin value is not given for most nuclei in their ground state, since they have T=$|\ T_z\ |=\frac{1}{2}|\ (N-Z)\ |$. However, it is included for the ground state of the $N=Z$, odd-odd ^{34}Cl, ^{42}Sc, ^{46}V, ^{50}Mn, ^{54}Co, ^{62}Ga, ^{66}As, ^{70}Br, and ^{74}Rb ($T=1$) and ^{30}P, ^{38}K, and ^{58}Cu ($T=0$) nuclides.

Detailed experimental information about IAS was recently compiled in Refs. [8, 9].

2.3 Half-life

The lifetime is a fundamental property of a nuclear level. It is related to the total decay width, Γ, a linear sum of all partial decay widths (γ ray, conversion electrons, α decay, β decay, fission, etc.), through the uncertainty relationship:

$$\Gamma = \frac{\hbar}{\tau} \qquad (1)$$

where τ=T$_{1/2}$/ln(2) is the level mean life and T$_{1/2}$ is the half-life.

Figures 3 displays the ground-state half-life as a function of N and Z for all nuclei included in Table I.

Some light nuclei (A<30) that are located beyond the particle drip-lines are known to exist for a very short time before disintegrating by particle emissions. In such cases only the total level width can be measured and the half-life is deduced by means of equation 1 (in convenient units):

$$T_{1/2}\ [\mathrm{s}] \simeq 4.562 \times 10^{-22}/\Gamma\ [\mathrm{MeV}] \qquad (2)$$

where Γ is the total width in the center of mass frame. The

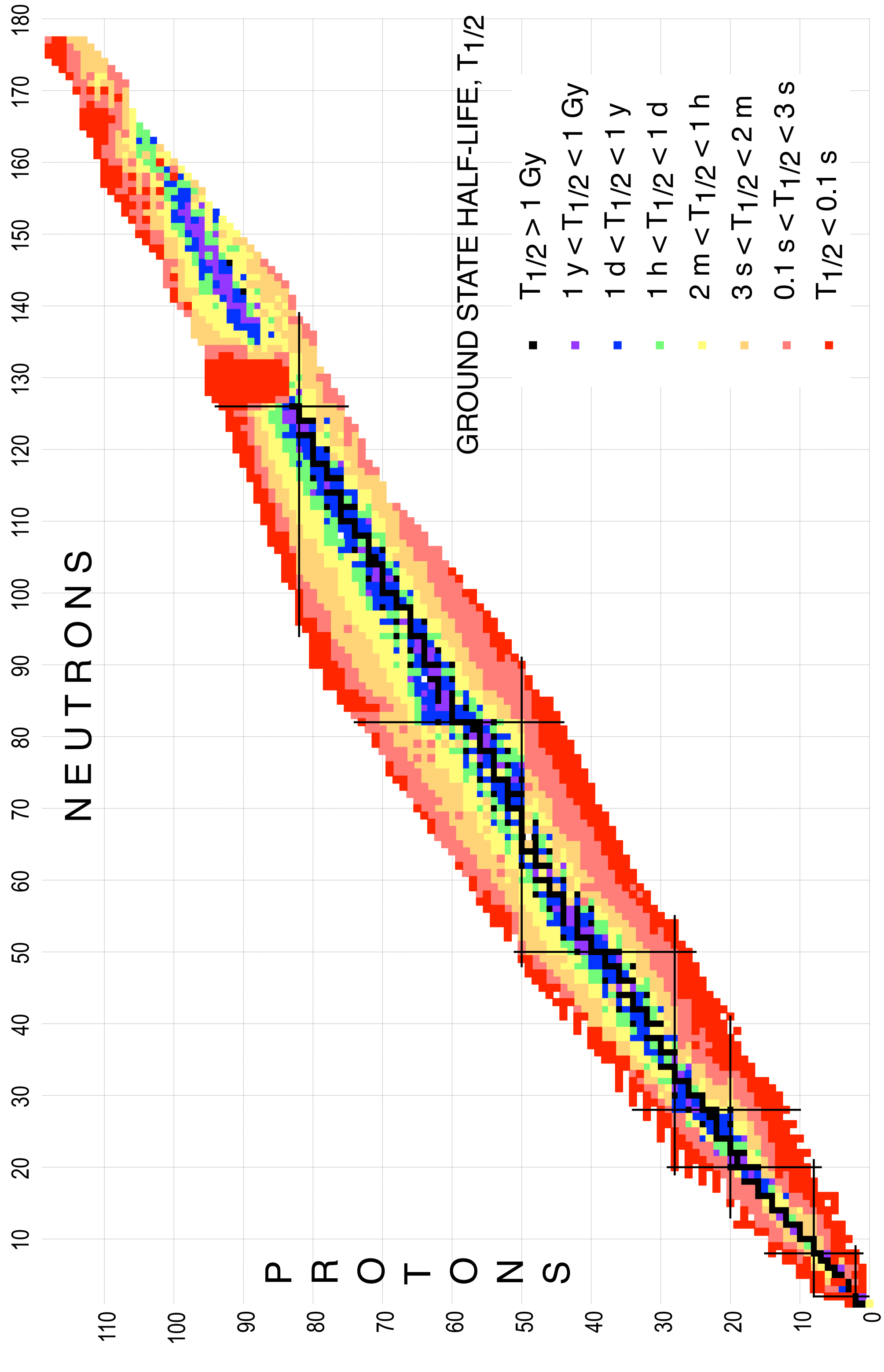

Fig. 3. Nuclear chart displaying the ground-state half-lives for all nuclei.

heaviest nuclide whose half-life is determined by this approach is ^{29}Cl.

The following units are used in NUBASE2020 for a convenient display of half-lives: seconds (s) and its sub-units, minutes (m), hours (h), days (d) and years (y), and its sub-units (see Explanation of Table I for details). While several definitions can be used to convert values between years and days or seconds, such as Julian year, Gregorian year, Sidereal year, Tropical year and others, the conversion via Tropical year is adopted in NUBASE2020:

$$1\, y = 365.2422 \text{ d} = 31556926 \text{ s}$$

When more than one value is known for the half-life of a particular level, a statistical analysis was performed in accordance with the policies outlined in section 3.2. Experimental half-lives are sometimes given in the literature with most probable lower and upper limits. Such cases are treated with uniform probability distribution, as explained in section 3.2. For example, the half-life of ^{97}In^m is given as 1.2 μs$\leq$T$_{1/2}$$\leq$230 μs in Ref. [2018Pa20] and the recommended value in NUBASE2020 is T$_{1/2}$=120(70) μs. Half-lives with asymmetric uncertainties are also frequently reported in the literature. Since it is envisioned that NUBASE2020 will be used by specialists in various application fields, such values are symmetrized prior to performing any statistical analyses, as described in section 3.3.

In experiments where rare events were detected, for example in studies of super-heavy nuclei, the half-lives reported in different publications were not directly averaged. Instead, when the information presented in the literature was sufficient, the time information associated with the individual events was combined and analyzed, as prescribed by Schmidt *et. al.* [1984Sc13]. In recent review articles that deal with properties of super-heavy nuclei [2014Kh04,2016Fo10,2016Ho09,2017Og01] events from several experiments were combined together in order to determine the best values. We have adopted these half-life values, rather than averaging the individual results.

In cases of long-lived nuclides that are of importance to metrology and other applications, all available experimental data were carefully examined, including values published by various metrology laboratories over many years. As a policy, we adopted the latest reported value by a particular laboratory, including the latest results published by Unterweger and Fitzgerald [10], which superseded the earlier assessment made by the same authors [11].

An upper or a lower limit for the half-life value is given in Table I for nuclides identified using a time-of-flight technique. The following policies were implemented: a) for *observed* nuclides, the lower limit for the half-life is given in the place of the uncertainty field. However, such a value should be used with caution, since it may be far shorter than the actual level half-life. In order to avoid confusion, a somewhat more realistic estimate, derived from TNN and flagged with #, is also given (see for example the data entry for ^{44}Si). The same notation is also used for half-life limits of very long-lived (stable) nuclei (see for example the data entry for ^{188}Os); b) for nuclides that were looked for, but *not observed*, the upper limit is given in the place of the uncertainty field. For example, upper limits were estimated for a number of unobserved nuclides by F. Pougheon [1993Po.A], based on the time-of-flight information and the production yields expected from TNN (see for example the data entry for ^{21}Al).

In the course of this work it was found that half-lives for double β-decaying nuclides were not always consistently given in ENSDF. Since the two-neutrino ground-state-to-ground-state transition is the dominant decay mode, only those experimental half-life values, or their upper-limits, are included in NUBASE2020. In a few cases, other partial lifetime data are also compiled and these are given as comments in Table I. No attempt was made to convert the half-life values given by different authors to the same statistical confidence level (CL). The compilations by Barabash [2020Ba.A,2011Ba28] were consulted in covering such decays.

For nuclei in their ground or excited isomeric state whose half-lives were not directly measured, values from TNN were estimates and included in Table I, whenever possible. Such cases are flagged with the symbol '#'.

2.4 Spin and parity

Spin and parity values are presented with or without parentheses, based on "weak" or "strong" arguments, respectively, as adopted in ENSDF [12], but with one important exception. Since, it is a policy of NUBASE2020 to make a clear distinction between experimental and non-experimental information, parentheses are used only when the so-called "weak" arguments are based on experimental observations. In cases where the assignments are based on theoretical predictions or TNN, the values are presented without parentheses and they are flagged with the symbol '#'. This is in contrast to ENSDF, where values determined from theory or systematics are given in parentheses, and as a consequence, it is not possible to distinguish these tentative values from ones determined from experimental data. It should also be noted, that despite well-defined evaluation policies [12], there are a number of inconsistencies in ENSDF regarding the spin and parity assignments. Often, the proposed spins and parities reflect the interpretation of a particular ENSDF evaluator, rather than that of firm policy rules. As a result, assignments to similar states in neighboring nuclei are put in parenthesis by one evaluator, but not by another, although similar experimental information is available.

There is a large amount of recent experimental data on directly measured spins for nuclei far from the line of stability, where the "in-source" (e.g. RILIS at ISOLDE (CERN) and TRILIS at ISAC (TRIUMF)) and "collinear" (e.g. CRIS at ISOLDE (CERN)) laser spectroscopy techniques were de-

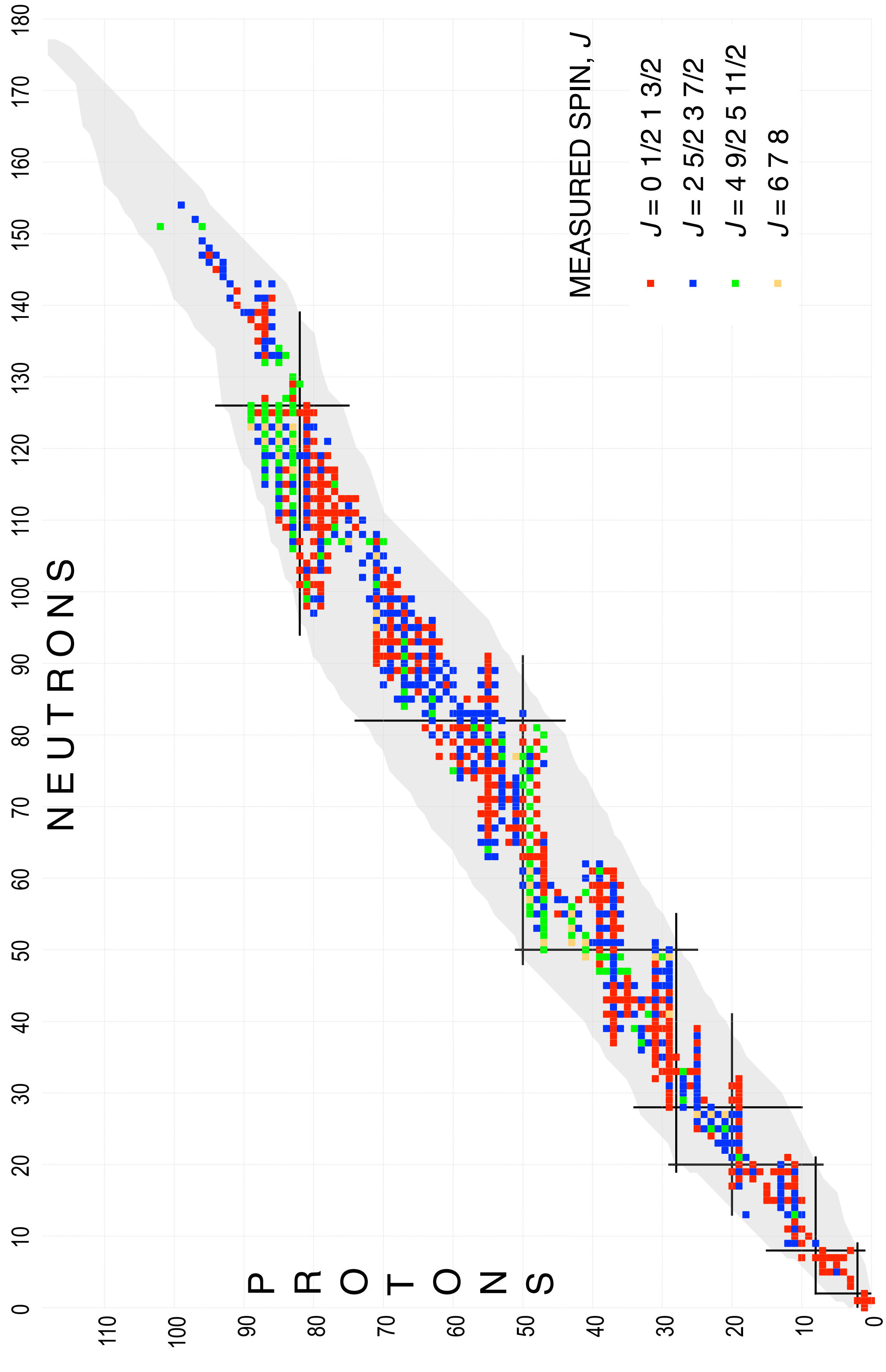

Fig. 4. Nuclear chart displaying the measured ground-state spins.

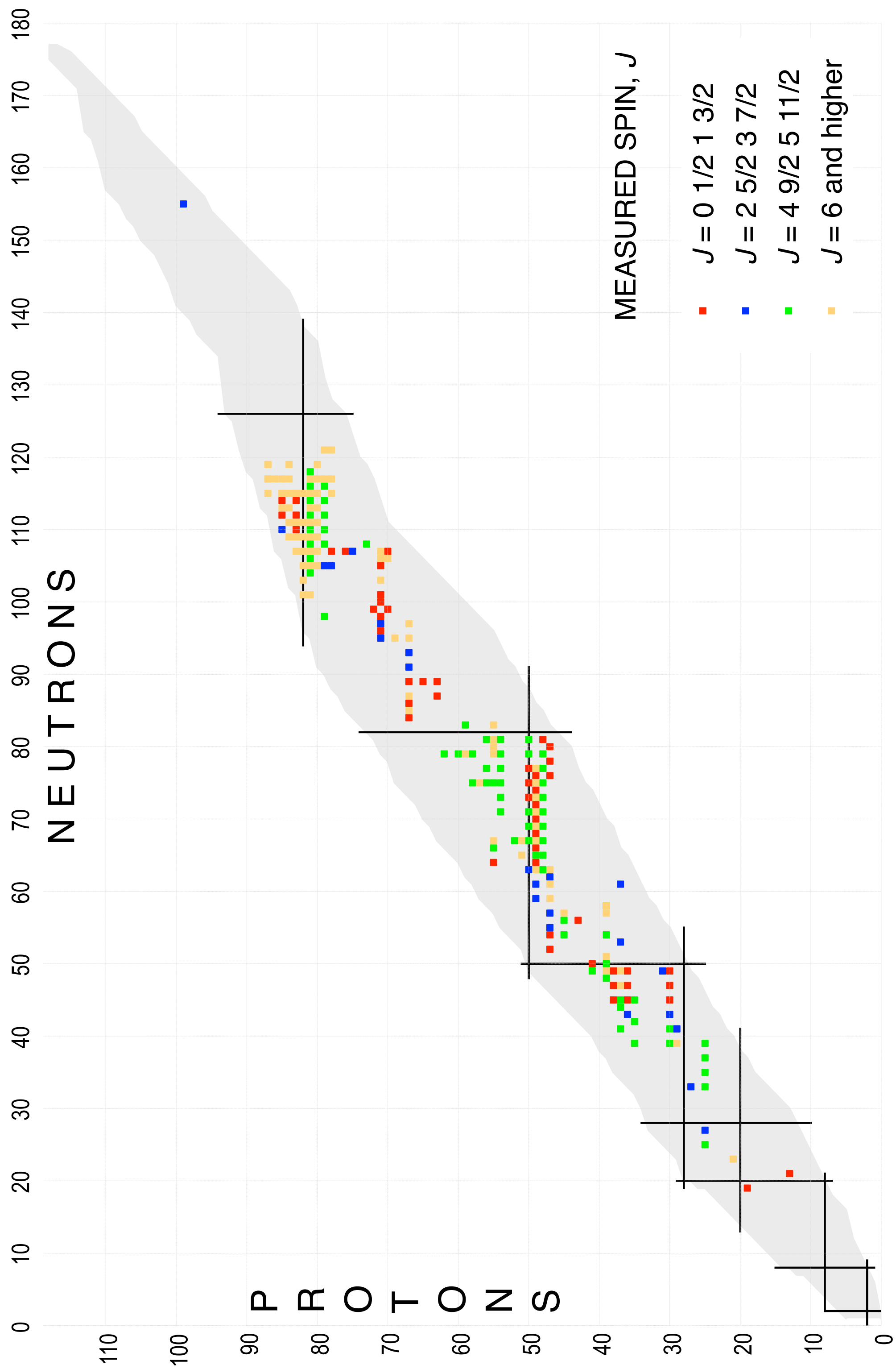

Fig. 5.   Nuclear chart displaying the measured isomeric-state spins.

ployed. In the present work, we compiled the experimentally measured spins for 1062 states (827 ground states and 235 isomers) and the corresponding values are flagged in Table I with the symbol '*'. We have consulted previous compilations by Fuller [13], Otten [1989Ot.A] and McDonald [14], as well as recently measured values in the literature. Figures 4 and 5 show plots of the directly measured spins for the ground and isomeric states, respectively, as a function of N and Z.

The experimental methods that are used for spin determination do not provide direct information about the parity of a given state. However, we have used additional spectroscopy data, such as l value in transfer reactions, hindrance factors in α decay, measured magnetic moments, as well as other spectroscopic information, in order to make such assignments in Table I.

2.5 Decay modes and their intensities

Figure 6 displays the main ground-state decay modes for all nuclei included in Table I.

The most important policy in assembling the information about the decay modes and their intensities was to unambiguously establish whether a particular decay is energetically allowed, but not experimentally observed (represented by a question mark alone '?', e.g. 'IT ?' or 'α ?', the question mark refers to the decay mode), and whether the decay is actually observed, but its intensity is not determined (represented by '=?', e.g. 'IT =?' or 'α=?', the question mark refers to the branching intensity).

In cases of multiple decay modes, normalization of primary intensities to 100% was made only when the competing decays were experimentally observed. Otherwise, no such corrections were made.

Similarly to previous versions of NUBASE [1–4], β^+ denotes a decay process that includes both electron capture, ε, and positron emission, e^+, decays, so that one can symbolically write $\beta^+ = \varepsilon + e^+$. It should be made clear that this notation is *not* the same as that used in ENSDF, where the combination of both modes is labeled as $\varepsilon + \beta^+$. When the available decay energy is below $2m_e \simeq 1022$ keV, only electron capture decay mode is allowed, while above that value the two processes are in competition. In the latter case, the separated intensities are not always experimentally available and they are frequently deduced from model calculations. Following one of the general policies of NUBASE that experimental information is exclusively used whenever possible, only measured values for β^+, ε and e^+ are included in Table I. By the same token, both electron capture-delayed fission (εSF) and positron-delayed fission (e^+SF) are given with the same symbol β^+SF.

For β-delayed particle decays, intensity relations were carefully considered. By definition, the intensity of a specific β-delayed particle decay is taken as a percentage of the main β-decay mode. For example, if the decay of the (A, Z) nuclide is described as 'β^-=100; β^-n=20', this means that for 100 decays of the parent, 80 (A, Z+1) and 20 (A–1, Z+1) daughter nuclei are produced and that 100 electrons and 20 delayed neutrons are emitted.

This notation also holds for more complex β-delayed particle emissions. For example, a decay described by 'β^-=100; β^-n=30; β^-2n=20; $\beta^-\alpha$=10' corresponds to the emission of 100 electrons, 70 (30+2×20) delayed-neutrons and 10 delayed-α particles; and in terms of residual nuclides, to 40 (A, Z+1), 30 (A–1, Z+1), 20 (A–2, Z+1) and 10 (A–4, Z–1), respectively.

In general, the number of neutrons emitted per 100 β^- decays, P_n, can be written as:

$$P_{\rm n} = \sum_i i \times \beta^-_{i\rm n};$$

and similar expressions can be written for β^--delayed α and proton emissions. The number of residual daughter nuclides (A, Z+1) populated via β^- decay is then:

$$\beta^- - \sum_i \beta^-_{i\rm n} - \sum_j \beta^-_{j\alpha} - \dots$$

Sometimes, the primary (parent) β decay can populate several excited states in the daughter nuclide, which can further decay by particle emission. However, in a case where the ground state of the daughter nuclide decays also by the same particle emission, some authors included its decay in the value for the corresponding β-delayed particle intensity. It is a policy of NUBASE2020 to not use such an approach for two main reasons: a) the energies of delayed particles emitted from excited states are generally much higher compared to those emitted from the ground state, thus implying different subsequent processes; b) the characteristic decay times from excited states are related to the parent, whereas decays from the daughter's ground state are connected to the daughter nuclide itself. For example, ^{9}C decays via β^+ emission to the ground state of the proton-unbound ^{9}B nuclide (feeding intensity of 54.1(1.5)% [2001Be51]) and to several excited states that are proton and/or α unbound. If one takes the β^+ intensities to the excited states in ^{9}B from Ref. [2000Ge09] and renormalizes them to per 100 decays of the parent, then β^+p=7.5(0.6)% and $\beta^+\alpha$=38.4(1.6)% can be determined for ^{9}C. In a slightly different example, ^{8}B decays via β^+ emission only to two excited, α-unbound states in ^{8}Be, but not to the ^{8}Be ground state. Thus, one may write β^+=100% and $\beta^+\alpha$=100%, and therefore, no net population of the ^{8}Be ground state.

It should be pointed out that the percentages given in the Table I are related to 100 decays of the parent nuclei, rather than to the primary decay mode fraction. For example, the delayed-fission probability in the decay of ^{228}Np is given in the original article as 0.020(9)% [1994Kr13], but this value is relative to the ε process, which has an intensity of 60(7)%. Thus, the renormalized delayed-fission intensity is 0.020(9)% × 0.60(7) = 0.012(6)% of the total decay intensity.

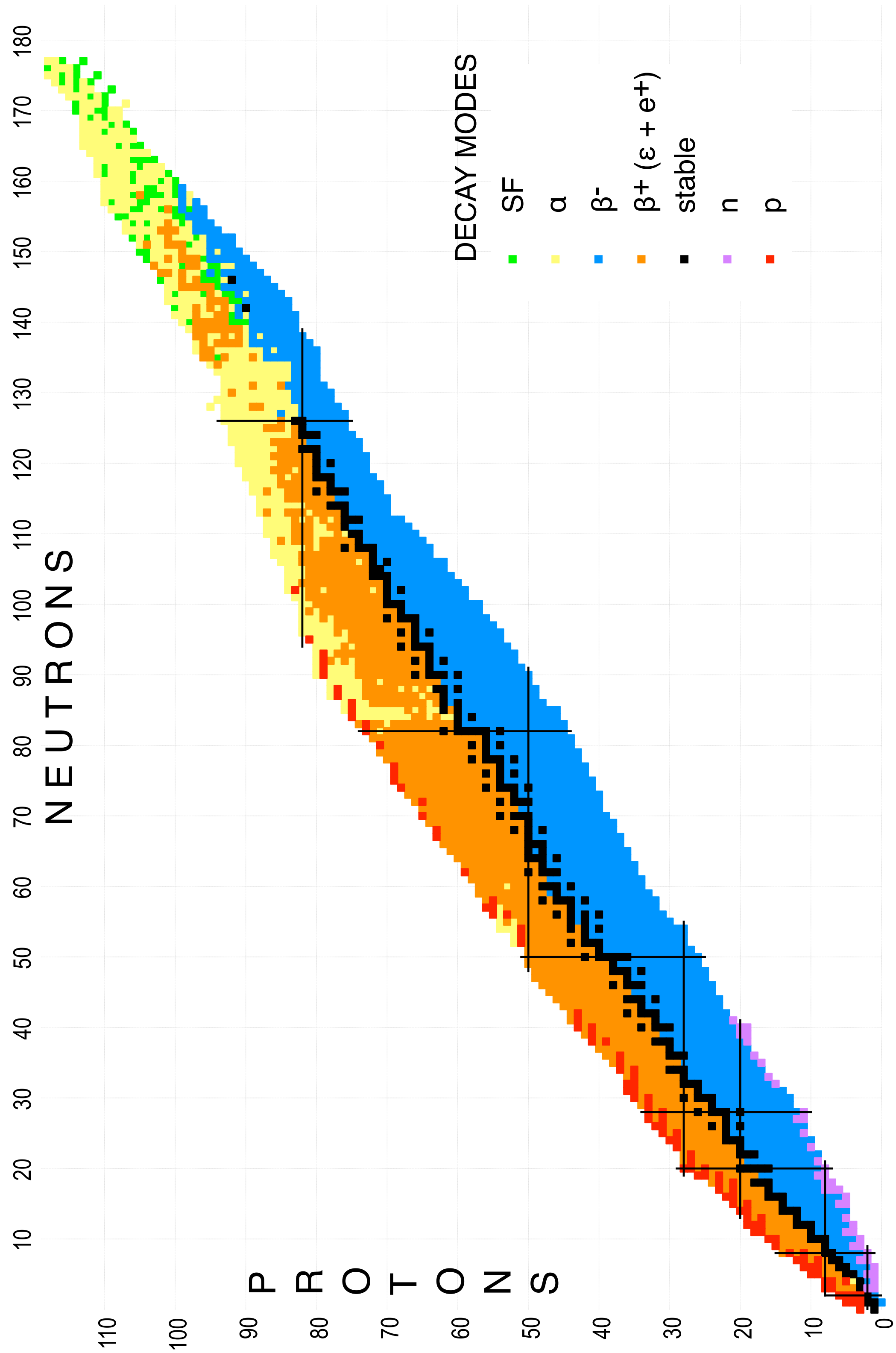

Fig. 6.   Nuclear chart displaying the main decay mode for nuclei in their ground state.

In addition to applying direct updates from the literature, partial evaluations completed by other authors were also considered in the evaluation of delayed particle data. For example, in compiling data for delayed proton- and α-branching intensities, the work of Hardy and Hagberg [1989Ha.A], Jonson and Riisager [15], Blank and Borge [16] and Pfützner *et al.* [17], where the corresponding physics was reviewed, as well as the recent compilation of Batchelder [18], were consulted. Similarly, data on β-delayed neutron emission probabilities that were recommended by a recent IAEA Coordinated Research Project [19] were also consulted.

2.6 Isotopic abundances

Isotopic abundances are given in the decay field of Table I with the symbol *IS* and the values were taken from the most-recent publication of Meija *et al.* [20]. In several cases the *IS* values are listed in Ref. [20] as an interval $[a,b]$, but in Table I they are given as $IS = (a+b)/2$ with a variance $\sigma^2 = (b-a)^2/12$ (see section 3.2).

2.7 Year of discovery

Similarly to the previous version of NUBASE [3, 4], Table I includes information about the year of discovery for each nuclide in its ground or isomeric state. For the former, recommendations by Thoennessen [21] were adopted. Similar criteria were used when assigning the year of discovery for isomeric states.

2.8 References and Dissemination

The year of the ENSDF archival file that was consulted during the development of NUBASE2020 is given in Table I. The entry is left blank when information for a particular nuclide was not available in ENSDF.

The bibliographical information used in NUBASE2020 is referenced by means of the "Nuclear Science Reference" (NSR) database [22] keynumber style. However, references quoted in Table I are abbreviated with the first two digits of the year of publication being omitted from the NSR-style keynumbers. They are followed by up to three one-letter codes which specify the added or modified physics quantities (see the Explanation of Table I).

In cases where more than one reference was needed to describe a particular update, they were included as comments in Table I. No references were given for estimated values.

The initials of the former and present evaluators, e.g. GAU (G. AUDI), HWJ (W. HUANG), FGK (F. KONDEV), MMC (M. MACCORMICK), SAR (S. NAIMI) WGM (M. WANG), AHW (A. WAPSTRA), were used as reference keys where it may not be clear that the re-interpretation of data was made by the NUBASE evaluators.

In cases of directly measured spins, references are provided only to papers that were not included in the most-recent compilation of McDonald *et al.* [14].

The complete reference list is given at the end of this issue (see AME2020, Part II), together with the references used in AME2020.

The recommended data for the basic nuclear physics properties are also made available as an ASCII-formatted file (**nubase.mas20**) at the dissemination websites of the collaboration [23].

3 Policies of NUBASE2020

3.1 Trends in neighboring nuclei (TNN)

In general, NUBASE2020 contains numerical and bibliographical information for all known nuclei for which at least one property is experimentally known. However, it also includes results on yet unobserved nuclides, as well as data on properties (mostly excitation energy for isomers, half-lives and spins and/or parities) that are not yet measured. Such values are estimated from the systematics trends of a particular property in neighboring nuclei by ensuring a continuity in N, in Z, A, and in $N-Z$. This approach allowed to follow the behavior of a particular property as a function of N and Z in a consistent way and it proved beneficial in deducing values for other relevant properties. Similarly to AME2020, where masses estimated from Trends from the Mass Surface (TMS) are flagged with '#', the same symbol is used in NUBASE2020 to indicate non-experimental information inferred from TNN. It should be pointed out, however, that deviations from TNN are expected when nuclear structure effects, such as deformation and/or shape changes, occur. Such data were taken into account to the best knowledge of the present authors.

3.2 Averaging procedure and uncertainties

It is a policy of NUBASE2020 to use one standard deviation as a representation of uncertainties associated with the recommended values. Unfortunately, authors of research articles do not always clarify the meaning of their reported uncertainties and, under such circumstances, these values are assumed to be one standard deviation. In several instances, uncertainties are not given at all and in such cases they were estimated by the evaluators, considering the limitations of the employed experimental method. When both the statistical and systematic uncertainties were reported in the literature, they were combined in a quadrature by the NUBASE2020 evaluators.

Sometimes lower (l) and upper (u) limits of a particular quantity, q, are reported in the literature, e.g. $q \in [l,u]$. A policy of NUBASE2020 is that uniform probability distribution is assumed in such cases, which yields a mean value of $m = (l+u)/2$ and a standard deviation of $\sigma = (u-l)/\sqrt{12} \simeq 0.29 \times (u-l)$.

When results from two or more independent measurements were reported in the literature, the corresponding values were weighted by their reported uncertainties and averaged. The weighted average value and its uncertainty are cal-

culated as:

$$\bar{x} \pm \Delta\bar{x} = \sum_{i=1}^{N} w_i x_i / \sum_{i=1}^{N} w_i \pm \sqrt{1/\sum_{i=1}^{N} w_i} \tag{3}$$

where w_i=1/Δx_i^2 and x_i and Δx_i are the value and its uncertainty reported in the i^{th} experiment, and the summation is over all N experiments. For each average value the NORMALIZED CHI, χ_n (or 'consistency factor' or 'Birge ratio'), defined as:

$$\chi_n = \sqrt{\frac{1}{N-1} \sum_{i=1}^{N} w_i (x_i - \bar{x})^2} \tag{4}$$

is also calculated.

It is a policy of NUBASE2020 to use the weighted average result (equation 3) when χ_n is smaller or equal to 2.5. In cases where χ_n is larger than 2.5, but less or equal to 4, departure from the statistical result (equation 3) is allowed and the *external* uncertainty for the average value is adopted:

$$\bar{x} \pm \Delta\bar{x} = \sum_{i=1}^{N} w_i x_i / \sum_{i=1}^{N} w_i \pm \chi_n \times \sqrt{1/\sum_{i=1}^{N} w_i} \tag{5}$$

In rare cases when χ_n is larger than 4, all individual uncertainties are considered to be irrelevant and the arithmetic (unweighted) average is adopted:

$$\bar{x} \pm \Delta\bar{x} = \frac{1}{N} \sum_{i=1}^{N} x_i \pm \sqrt{\frac{1}{N(N-1)} \sum_{i=1}^{N} (x_i - \bar{x})^2} \tag{6}$$

The values used in the statistical analysis of a particular quantity are given as comments in Table I. When contradictory (discrepant) results were identified in the literature, a great deal of attention was focused on establishing the reason for such discrepancies, and consequently, on rejecting (or correcting) the corresponding unreliable data prior to performing the statistical analysis. The reasons for such decisions are given as comments in Table I.

3.3 Symmetrization of asymmetric uncertainties

Experimental results are sometimes reported in the literature with asymmetric uncertainties, e.g. X^{+a}_{-b}, and it is a policy of NUBASE to symmetrize these uncertainties.

Similarly to the previous version of NUBASE [1–4], the asymmetric uncertainty is associated with a two-piece normal distribution (sometimes called "split-normal distribution" or "Fechner distribution"), $TN(X,a,b)$, and the symmetrization is achieved by mapping this distribution into a normal (symmetric) distribution, $N(\mu,\sigma)$, where μ is the mean value and σ is the standard deviation.

The probability density function of a two-piece normal distribution is given as:

$$f(x) = \begin{cases} A \times \exp[-(x-X)^2/2a^2] & \text{if x > X}, \\ A \times \exp[-(x-X)^2/2b^2] & \text{if x < X} \end{cases} \tag{7}$$

It has a modal (most probable) value of $x = X$, a standard deviation b for $x<X$ and a standard deviation a for $x>X$ (see Figure 7), with $A = (\sqrt{\pi/2} \times (a+b))^{-1}$. This distribution is formed by taking the left half of a normal distribution $N(X,b)$ and the right half of a normal distribution $N(X,a)$ and scaling them to give a common value of f(x)=A at the mode X (see Figure 7). The mean value and the variance of this distribution can be determined as [24]:

$$\mu = X + \sqrt{2/\pi} \times (a-b) \tag{8}$$

$$\sigma^2 = (1-2/\pi) \times (a-b)^2 + a \times b \tag{9}$$

The median value m, which divides the distribution into two equal areas is then:

$$m = \begin{cases} X + a\sqrt{2} \times \mathrm{erf}^{-1}\left(\frac{a-b}{2a}\right) & \text{if a > b}, \\ X + b\sqrt{2} \times \mathrm{erf}^{-1}\left(\frac{a-b}{2b}\right) & \text{if b > a}. \end{cases} \tag{10}$$

If one takes $\mathrm{erf}^{-1}(z) \simeq \sqrt{\pi}z/2$ then

$$m - X \simeq \sqrt{\pi/8} \times (a-b) \simeq 0.6267 \times (a-b) \tag{11}$$

In order to allow for a small non-linearity that appears for high values of $m - X$, equation 11 is modified to:

$$m \simeq X + 0.64 \times (a-b) \tag{12}$$

Following the above approach, the two-piece normal distribution $TN(X,a,b)$ is mapped into an equivalent normal (symmetric) distribution N(m,σ) (see Figure 7) that have a mean value equal to the median value m (equation 12) and variance σ (equation 9). As a consequence, X^{+a}_{-b} is symmetrized to $m\pm\sigma$ and the latter is adopted in NUBASE2020.

3.4 Rounding policy

In general, values for properties presented in NUBASE2020 and their uncertainties are rounded off, even if unrounded ones were given in the literature or in ENSDF. However, for some very precise data, as well as for data that were deemed essential for traceability purposes (e.g. isotopic abundances), the precisions quoted in the original publications were retained.

In cases where the two furthest-left significant digits in the uncertainty were larger than a given limit (set to *30* for the mass excess and excitation energy of isomers in order to be consistent with AME, and set to *25* for half-lives and branching ratios, as generally used in ENSDF), the adopted values and corresponding uncertainties were rounded off accordingly.

4 Conclusions and outlook

The NUBASE2020 evaluated nuclear data library contains the recommended values for the basic nuclear physics properties for all known nuclei, such as mass excess, excitation

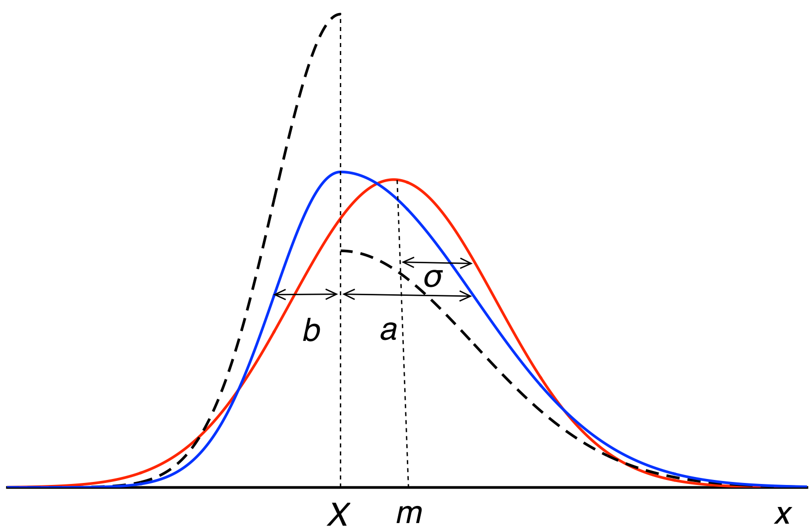

Fig. 7. (dashed black) original Normal distributions, $N(X,b)$ (left on X) and $N(X,a)$ (right on X), associated with the measured quantity X^{+a}_{-b}; (solid blue) a two-piece normal distribution $TN(X,a,b)$; (solid red) the equivalent Normal (symmetric) distribution, $N(m,\sigma)$; see section 3.3 for details.

energy of the excited isomeric state, half-life, spin and parity, decay modes and their intensities, isotopic abundance (for stable nuclides), year of discovery, as well as the corresponding bibliographical information. It also contains information for yet unobserved nuclei whose properties were estimated by following the systematic trends in neighboring nuclei.

One of the main requirements in the development of NUBASE2020 was to cover the available experimental data as completely as possible and to provide proper references to all experimental results, especially for cases that are not included in ENSDF or in other topical evaluations. Such a traceability would allow any user to promptly review the recommended data and, if necessary, to undertake a re-evaluation.

NUBASE2020 is an integral part of AME2020 and the synchronization of these two libraries allows better homogeneity of all experimental data to be achieved. Furthermore, assignments of isomeric states and determination of their excitation energies were put on a firm basis and the data were improved.

In the future development of NUBASE, it is envisioned to include additional nuclear properties, such as magnetic and quadrupole moments, charge-radii and isotope shifts, cross sections of importance to nuclear astrophysics applications, as well as additional decay properties of relevance to energy and non-energy applications, in order to better serve the broader nuclear physics community.

5 Acknowledgments

This work was supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics, under Contract No. DE-AC02-06CH11357 (ANL) and in part by the National Key Research and Development Program of China (Grant No. 2016YFA0400504) and the Strategic Priority Research Program of Chinese Academy of Sciences (CAS, Grant No. XDB34000000) (IMP). W.J. Huang acknowledges the financial support by the Max-Planck-Society. S. Naimi acknowledges the support of the RIKEN Pioneering Project Funding.

We thank many colleagues who responded to our queries about the experimental data, as well as those who sent us preprints of their work prior publication. We also thank D. Lunney and B. Kay for the careful reading of the manuscript and useful comments.

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Table I. The NUBASE2020 table of nuclear and decay properties

EXPLANATION OF TABLE I

Data are presented in groups ordered by increasing mass number, A.

Nuclide — Nuclide name: mass number $A = N + Z$ and element symbol. The superscript suffixes 'm', 'n', 'p', 'q', 'r' and 'x' indicate assignments to excited isomeric states with a half-life greater than 100 ns. Suffixes 'p' and 'q' can also indicate non-isomeric levels, which are used in AME2020. Suffix 'r' can also indicate a state from a proton resonance occurring in (p,γ) reactions (e.g. ^{28}Si^r). Suffix 'x' can also indicate a mixture of levels with a relative ratio, R, given in the 'Half-life' column. They occur in spallation reactions or fission and are labeled as 'spmix' or 'fsmix' in the 'J^π' column, respectively. Suffixes 'i' and 'j' indicate Isobaric Analog States.

Mass excess — Mass excess [M(in u)$-A$] and its uncertainty (one standard deviation) in keV, as recommended in AME2020.

Rounding policy: in cases where the furthest-left significant digit in the uncertainty is larger than 3, values are rounded-off, but not to more than tens of keV. (Examples: $2345.67 \pm 2.78 \rightarrow 2345.7 \pm 2.8, 2345.67 \pm 4.68 \rightarrow 2346 \pm 5$, but $2346.7 \pm 468.2 \rightarrow 2350 \pm 470$).

- # indicates that the Mass excess value and its uncertainty are not derived from experimental data, but at least partly from the Trends from the Mass Surface (see the AME2020 publication for details).

Excitation energy — The energy difference between the excited isomer and the ground state, and its uncertainty (one standard deviation) in keV. The rounding policy is the same as for the mass excess (see above), with the exception of the very precise values for the ^{229}Th^m and ^{235}U^m isomers, which are given in the comments.

- # indicates that the excitation energy and its uncertainty are not derived from experimental data, but from the Trends in Neighboring Nuclei (TNN) (see section 3.1)

When the excitation energy is determined by an *external* relation, it is followed by one or two-letters code (the origin code) that indicates the method used to establish such a relation. The field is left blank when the value is derived from γ-ray spectroscopy data (*internal* relation):

MD	mass doublet
RQ	reaction Q-value
AD	α energy difference
BD	β-decay end-point energy data
p, 2p	one-, two-proton decay
IT	combination of AME and γ-ray spectroscopy data
Nm	estimated value derived using the Nilsson model

When the existence of a nuclide or an isomer is questionable the following codes are used:

- EU — the existence is under discussion (e.g. ^{185}Bi^n). If the existence is strongly doubted, no excitation energy and mass excess values are given, and they are replaced by the keyword "non-exist" (e.g. ^{138}Pm^m).
- RN — the isomer has been proven not to exist (e.g. ^{181}Pb^m). Excitation energy and mass excess values are replaced by the keyword "non-exist".

  Remark: codes EU and RN are also used when the discovery of a nuclide is questioned (e.g. ^{260}Fm and ^{289}Lv). In this case, a mass excess value derived from the Trends from the Mass Surface (see the AME2020 publication for details) is always given for the ground state.

Isomer assignment:

$*$	when the available experimental information is insufficient to unambiguously determine which state is the ground state and which one is the excited isomer, as well as in cases where the uncertainty (ΔE_x) of the excitation energy (E_x) is greater than half the excitation energy value ($\Delta E_x > E_x/2$), these quantities are followed by an asterisk (see for example ^{102}Y and ^{102}Y^m).
&	when the ordering of the ground state and the excited isomer is reversed in comparison to the assignment made in ENSDF, the ampersand sign is added in the table (see for example ^{100}Y and ^{100}Y^m).

Half-life — Half-life value (see section 2.3).

s = seconds; m = minutes; h = hours; d = days; y = years; 1 y = 365.2422 d = 31 556 926 s.

STABLE = stable nuclide or nuclide for which no finite half-life value was established.

indicate non-experimental value estimated from Trends in Neighboring Nuclei (TNN) (see section 3.1).

subunits:

ms	:	10^{-3}	s	millisecond	ky	:	10^{3}	y	kiloyear
μs	:	10^{-6}	s	microsecond	My	:	10^{6}	y	megayear
ns	:	10^{-9}	s	nanosecond	Gy	:	10^{9}	y	gigayear
ps	:	10^{-12}	s	picosecond	Ty	:	10^{12}	y	terayear
fs	:	10^{-15}	s	femtosecond	Py	:	10^{15}	y	petayear
as	:	10^{-18}	s	attosecond	Ey	:	10^{18}	y	exayear
zs	:	10^{-21}	s	zeptosecond	Zy	:	10^{21}	y	zettayear
ys	:	10^{-24}	s	yoctosecond	Yy	:	10^{24}	y	yottayear

J^{π} — Spin and parity (see section 2.4):

()	uncertain spin and/or parity based on *weak* experimental arguments.
*	directly measured spin (see section 2.4).
#	non-experimental value estimated from Trends in Neighboring Nuclei (TNN) (see section 3.1) or from theoretical predictions.
high	high spin.
low	low spin.
am	same J^{π} as the α-decay parent nuclide.
T	isospin multiplet value for Isobaric Analog States (see section 2.2.1).

Ens — Year of the ENSDF file archive. In order to reduce the width of the table, the two century digits are omitted.

Reference — Reference key-numbers (see section 2.8). In order to reduce the width of the table, the two century digits are omitted from the NSR reference key. The complete references list and associated NSR reference key-numbers are given in the second AME publication in the present volume.

10Cr02	updates derived from a *primary* (journal article) reference with the keynumber taken from the "Nuclear Science Reference" (NSR) database [22] (see section 2.8). When the keynumber was not available, the style 12Ma.1 was provisionally adopted.
12Dr.A	updates derived from a *secondary* (abstract, preprint, private communication, not-refereed conference proceeding, thesis or laboratory report) reference.
AHW	(or GAU, HWJ, FGK, MMC, SAR, WGM), re-interpretation by one of the NUBASE evaluators.
Mirror	deduced from mirror nuclide properties.
Imme	deduced from Isobaric Multiplet Mass Equation.

The reference key-numbers are followed by codes having up to three letters that indicates which physics quantity was added or modified:

M	mass excess
E	isomer excitation energy
T	half-life
J	spin and/or parity
D	decay mode and/or its intensity
I	identification

Year of discovery Year of discovery assigned for the ground and excited isomeric states (see section 2.7).

Decay modes and intensities Decay modes followed by their intensities and associated uncertainties, both in % (see section 2.5). The ordering is according to decreasing intensities. The uncertainties are given by the ENSDF-style format, e.g. α=25.9 23 stands for α=25.9 % $\pm$ 2.3 %. The notation 1.8e–12 stands for 1.8×10^{-12}.

α ? means that the α-decay mode is energetically allowed, but not experimentally observed

α=? means that the α-decay is observed, but its intensity is not experimentally known

α	α emission	
p 2p	proton emission	2-proton emission
n 2n	neutron emission	2-neutron emission
ε	electron capture	
e^+	positron emission	
β^+	β^+ decay	$(\beta^+ = \varepsilon + e^+)$
β^-	β^- decay	
$2\beta^-$	double β^- decay	
$2\beta^+$	double β^+ decay	
β^-n	β^--delayed neutron emission	
β^-2n	β^--delayed 2-neutron emission	
β^-3n	β^--delayed 3-neutron emission	
β^+p	β^+-delayed proton emission	
β^+2p	β^+-delayed 2-proton emission	
β^+3p	β^+-delayed 3-proton emission	
$\beta^-\alpha$	β^--delayed α emission	
$\beta^+\alpha$	β^+-delayed α emission	
β^-d	β^--delayed deuteron emission	
β^-t	β^--delayed triton emission	
IT	internal transition	

SF	spontaneous fission
β^+SF	β^+-delayed fission
β^-SF	β^--delayed fission
^{24}Ne	heavy cluster emission

For stable or long-lived nuclides:

IS	Isotopic abundance taken from Ref. [20] (see section 2.6).

$*$ Indicates a comment to a nuclide, which is given below the block of data corresponding to the same A. The asterisk symbol is also included at the end of the data line. The comment starts with a letter code, similar to the one that follows the reference key-number (see above), indicating to which physics quantity the remark is applied. It contains: *(i)* information explaining how a specific value was derived; *(ii)* reasons for changing a value or its uncertainty that were reported by the original authors, or for rejecting it; *(iii)* complementary references to updated data; *(iv)* individual values used in the statistical analysis of data.

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{1}n	8071.3181	0.0004				609.8	s	0.6	$1/2^+*$	06	19Ma40	T	1932	β^-=100	*
^{1}H	7288.9710	0.0001				STABLE			$1/2^+*$	06	11Be53	D	1920	IS=99.9855 78	*
$*^{1}$n	T : from the world average in 19Ma40=609.8(0.6) (τ=879.7(0.8) s)														**
$*^{1}$H	M : rounded from 7288.971064(0.000013) keV														**
^{2}H	13135.7229	0.0001				STABLE			1^+*	03			1932	IS=0.0145 78	*
$*^{2}$H	M : rounded from 13135.722895(0.000015) keV														**
^{3}H	14949.8109	0.0001				12.32	y	0.02	$1/2^+*$	00			1934	β^-=100	*
^{3}He	14931.2188	0.0001				STABLE			$1/2^+*$	98			1934	IS=0.0002 2	*
^{3}Li	28670#	2000#				p-unstable			$3/2^-$#	98				p ?	*
$*^{3}$H	M : rounded from 14949.81090(0.00008) keV														**
$*^{3}$He	M : rounded from 14931.21888(0.00006) keV														**
$*^{3}$Li	I : identification in 69Wi13 not accepted														**
^{4}H	24620	100				139	ys	10	2^-	98	03Me11	T	1981	n=100	*
^{4}He	2424.9158	0.0001				STABLE			0^+	98			1908	IS=99.9998 2	*
^{4}Li	25320	210				91	ys	9	2^-	98	65Ce02	T	1965	p=100	
$*^{4}$H	T : width=3.28(0.23) MeV; other 91Go19=4.7(1.0) outweighed, not used														**
$*^{4}$He	M : rounded from 2424.91587(0.00015) keV														**
^{5}H	32890	90				86	ys	6	$(1/2^+)$	19	17Wu03	T	1987	2n=100	*
^{5}He	11231	20				602	ys	22	$3/2^-$	02			1937	n=100	*
^{5}Li	11680	50				370	ys	30	$3/2^-$	02			1941	p=100	
^{5}Be	37140#	2000#				p-unstable			$1/2^+$#	18				p ?	
$*^{5}$H	T : from width=5.3(0.4) MeV in 17Wu03														**
$*^{5}$H	J : from angular distribution data consistent with $l = 0$ in 01Ko52														**
$*^{5}$He	T : from width=758(28) keV, average 12Lu01=767(10) keV														**
$*^{5}$He	T : 09Ak03=670 (12, stat) (30, syst) keV; Birge ratio=2.9														**
^{6}H	41880	250				294	ys	67	2^-#	19			1984	n ?;3n ?	*
^{6}He	17592.10	0.05				806.92	ms	0.24	0^+	02	15Pf01	D	1936	β^-=100;β^-d=0.000278 18	*
^{6}Li	14086.8804	0.0014				STABLE			1^+*	02			1921	IS=4.85 171	
^{6}Li^{i}	17649.76	0.10	3562.88	0.10		56	as	14	0^+ T=1	02	81Ro02	E	1981	IT=100	
^{6}Be	18375	5				5.0	zs	0.3	0^+	02			1958	2p=100	
^{6}B	47320#	2000#				p-unstable			2^-#					2p ?	
$*^{6}$H	T : from width=1.55(0.35) MeV, average 84Al08=1.8(5) MeV 86Be35=1.3(5) MeV														**
$*^{6}$He	D : other %β^-d 09Ra33=1.65(0.10)e-6, but with 525-keV threshold														**
$*^{6}$He	T : symmetrized from 12Kn01=806.89(0.11, stat)(+0.23-0.19, syst)														**
^{7}H	49140#	1000#				652	ys	558	$1/2^+$#	17	08Ca22	T	2003	2n ?	*
^{7}He	26073	8				2.51	zs	0.07	$(3/2)^-$	03	12Ca05	T	1967	n=100	*
^{7}Li	14907.105	0.004				STABLE			$3/2^-*$	03			1921	IS=95.15 171	
^{7}Li^{i}	26150	30	11250	30	RQ				$3/2^-$ T=3/2	03					
^{7}Be	15769.00	0.07				53.22	d	0.06	$3/2^-$	03			1938	ε=100	
^{7}Be^{i}	26750	30	10980	30	RQ				$3/2^-$ T=3/2	03				p ?;^{3}He ?;α ?	
^{7}B	27677	25				570	ys	14	$(3/2^-)$	14	11Ch32	T	1967	p=100	*
$*^{7}$H	T : symmetrized from 08Ca22=0.09(+94-6) MeV														**
$*^{7}$He	T : from width=182(5) keV in 12Ca05; others 09Ak03=190(30)														**
$*^{7}$He	T : 08De29=125(+40-15) 02Me07=150(80) 69St02=160(30) (outweighed)														**
$*^{7}$B	T : from width=801(20) keV in 11Ch32														**
^{8}He	31609.68	0.09				119.5	ms	1.5	0^+	05	15Bi05	TD	1965	β^-=100;β^-n=16 1; β^-t=0.9 1	*
^{8}Li	20945.80	0.05				838.7	ms	0.3	2^+	05	10Fl01	T	1935	β^-=100;$\beta^-\alpha$=100	*
^{8}Li^{i}	31768	5	10822	5	RQ				0^+ T=2	05					

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{8}Be	4941.67	0.04				81.9 as 3.7	0^+	05			1932	α=100	
^{8}Be^i	21568	3	16626	3			2^+ frg. T=1		04Ti06	E	2004	$\alpha\approx$100	
^{8}Be^j	32436.0	2.0	27494.3	2.0	RQ		0^+ T=2	05				n=39.4;d=27.0;^{3}H=11.7; α=7.9;p=6.9;^{3}He=6.6; IT=0.60	*
^{8}B	22921.6	1.0				771.9 ms 0.9	2^+	05	20Vi03	T	1950	β^+=100;$\beta^+\alpha$=100	*
^{8}B^i	33546	8	10624	8	RQ		0^+ T=2	05			1975		
^{8}C	35064	18				3.5 zs 1.4	0^+	18			1974	2p=100	*
*^{8}He	D : %β^-t intensity from 86Bo41												**
*^{8}Li	D : β^- decay to first 2+ state in ^{8}Be, which decays 100% by 2α												**
*^{8}Li	T : average 10Fl01=838.40(0.36) 03Wi17=839.60(1.06) 90Sa16=840.3(0.9)												**
*^{8}B	T : average 20Vi03=771.9(1.7),773.9(1.8),770.9(1.7), uncertainty in the												**
*^{8}B	T : last value from priv. comm. with the authors (from 2.7 to 1.7),												**
*^{8}B	T : 73McZW=772(4) 71Wi05=762(5) 64Ma35=774(4)												**
*^{8}C	T : from width=130(50) keV in 11Ch32												**
^{9}He	40940	50				2.5 zs 2.3	$1/2(^+)$	06	16Ub01	J	1987	n=100	*
^{9}Li	24954.91	0.19				178.2 ms 0.4	$3/2^-$	06	15Bi05	TD	1951	β^-=100;β^-n=50.5 10	
^{9}Be	11348.45	0.08				STABLE	$3/2^-$*	06			1921	IS=100	
^{9}Be^i	25738.8	1.7	14390.3	1.7	RQ	1.25 as 0.10	$3/2^-$ T=3/2	06			1976		
^{9}B	12416.5	0.9				800 zs 300	$3/2^-$	06			1940	p=100	
^{9}B^i	27071.0	2.3	14654.5	2.5	RQ		$3/2^-$ T=3/2	06					
^{9}C	28911.0	2.1				126.5 ms 0.9	$3/2^-$	06	01Be51	D	1964	β^+=100;β^+p=7.5 6; $\beta^+\alpha$=38.4 16	*
*^{9}He	T : from width=180(100) keV in 13Al14; other width=100(60) keV in 99Bo26												**
*^{9}C	D : %β^+p from %β^+(to ^{9}B gs)=54.1(1.5) from 01Be51 and %β^+(to ^{9}B exc)												**
*^{9}C	D : from 00Ge09, but renormalized in order to have %β^+(^{9}C)=100, and												**
*^{9}C	D : %p/%α from 00Ge09; %$\beta^+\alpha$=100 - %β^+(to ^{9}B gs) - %β^+												**
*^{9}C	J : from 04Ti06												**
^{10}He	49200	90				260 ys 40	0^+	07			1994	2n=100	*
^{10}Li	33053	13				2.0 zs 0.5	$(1^-,2^-)$	07	94Yo01	TJ	1975	n=100	
^{10}Li^m	33250	40	200	40	RQ	3.7 zs 1.5	1^+	07	97Zi04	T	1994	IT=100	*
^{10}Li^n	33530	40	480	40	RQ	1.35 zs 0.24	(2^+)	07	94Yo01	T	1993	IT=100	*
^{10}Be	12607.49	0.08				1.387 My 0.012	0^+	07	10Ch18	T	1935	β^-=100	*
^{10}Be^i	33787	21	21179	21	RQ		(2^-) T=2	07				n ?;p ?;^{3}H ?	
^{10}B	12050.611	0.015				STABLE	3^+*	07			1920	IS=19.65 44	
^{10}B^i	13790.66	0.04	1740.05	0.04			0^+ T=1	07				IT=100	
^{10}C	15698.67	0.07				19.3011 s 0.0015	0^+	07	16Du10	T	1949	β^+=100	*
^{10}N	38800	400				143 ys 36	$1^-,2^-$	17	17Ho10	TJ	2002	p ?	*
*^{10}He	D : most probably 2 neutron emitter from S2n=-1440(90) keV												**
*^{10}He	T : from width=1.76(0.27) MeV, average 10Ko43=1.8(4) and 10Jo06=1.73(0.36),												**
*^{10}He	T : the latter average of 1.11(0.76), assuming a single narrow resonance,												**
*^{10}He	T : and 1.91(0.41), assuming two overlapping resonances; others:												**
*^{10}He	T : width=2 MeV in 12Si07, 100-500 keV in 94Os04, <1.2 MeV in 94Ko16												**
*^{10}Li^m	T : from average width=120(+100-50) keV in 97Zi04 and 100(70) keV in 94Yo01												**
*^{10}Li^n	T : from average width=358(23) keV in 94Yo01, 150(70) keV in 93Bo03;												**
*^{10}Li^n	T : Birge ratio=2.8												**
*^{10}Be	T : average 10Ch18=1.386(0.016) 10Ko19=1.388(0.018)												**
*^{10}C	T : average 16Du10=19.2969(0.0074),19.3009(0.0017) 09Ba06=19.282(0.011)												**
*^{10}C	T : 08Ia01=19.310(0.004) 90Ba02=19.295(0.015) 74Az01=19.280(0.020)												**
*^{10}C	T : 74Ro21=19.150(0.030)												**
*^{10}N	T : from width=3.1(+0.9-0.7) MeV for J=2- in 17Ho10; other:												**
*^{10}N	T : width=2.5(+2.0-1.5) MeV for J=1- in17Ho10.												**
^{11}Li	40728.3	0.6				8.75 ms 0.06	$3/2^-$*	12	12Ke01	D	1966	β^-=100;β^-n=86.3 9; β^-2n=4.1 4;β^-3n=1.9 2; $\beta^-\alpha$=1.7 3;β^-d=0.0130 13; β^-t=0.0093 8	*
^{11}Be	20177.17	0.24				13.76 s 0.07	$1/2^+$*	12	19Re03	D	1958	β^-=100;$\beta^-\alpha$=3.3 1;	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
												β^-p=0.0013 3;β^-n ?	
^{11}Be^i	41336	20	21158	20	RQ	0.93 zs 0.13	$3/2^-$ T=5/2		MMC162J		1997	IT ?	*
^{11}B	8667.708	0.012				STABLE	$3/2^-$*	12			1920	IS=80.35 44	
^{11}B^i	21228	9	12560	9	RQ	T=3/2	$1/2^+,(3/2^+)$	12			1963		
^{11}B^j	42230	80	33570	80	2p		$3/2^-$ T=5/2		MMC146J				
^{11}C	10649.40	0.06				20.3402 m 0.0053	$3/2^-$*	12	18Va04	T	1934	β^+=100	*
^{11}C^i	22810	40	12160	40	RQ		$1/2^+$ T=3/2	12	71Wa21	D	1971	p=?	
^{11}N	24366	5				585 ys 7	$1/2^+$	12	19We11	T	1974	p=100	*
^{11}N^m	25110	60	740	60		690 ys 80	$1/2^-$	12	96Ax01	ETJ	1974	p=100	
^{11}O	47740	60				198 ys 12	$(3/2^-)$	20	20We08	TJ	2019	2p=100	*
*^{11}Li	T : average 97Mo35=8.99(0.10) 96Mu19=8.2(0.2) 95Re.A=8.4(0.2)												**
*^{11}Li	T : 81Bj01=8.83(0.12) and 74Ro31=8.5(0.2)												**
*^{11}Be	D : %$\beta^-\alpha$ from 19Re03=3.30(0.10); other 81Al03=2.9(4)												**
*^{11}Be	D : %β^-p from 19Ay03=0.0013(0.0003); others (indirect) 14Ri01=0.00083(9)												**
*^{11}Be	D : 20Ri02<0.00022%												**
*^{11}Be	J : 14Ta10=1/2												**
*^{11}Be^i	T : from width=490(70) keV in 97Te07												**
*^{11}C	T : from 18Va04 using world data												**
*^{11}N	T : from width=780(10) keV in 19We11												**
*^{11}O	T : from width=2.31 (0.14) MeV in 20We08; other width=2.46 MeV in 19Fo10												**
^{12}Li	49010	30					$(1^-,2^-)$	17	74Bo05	I	2008	n ?	
^{12}Be	25077.8	1.9				21.46 ms 0.05	0^+	17			1966	β^-=100;β^-n=0.50 3	
^{12}Be^m	27328.8	2.1	2251	1		233 ns 7	0^+	17			2007	IT=100	*
^{12}B	13369.4	1.3				20.20 ms 0.02	1^+*	17			1935	β^-=100;$\beta^-\alpha$=0.60 2	
^{12}B^i	26088	19	12719	19	RQ		0^+ T=2	17	08Ch28	J			
^{12}C	0.0	0.0				STABLE	0^+	17			1919	IS=98.94 6	
^{12}C^i	15108	3	15108	3	RQ		1^+ T=1	17				IT=?;α ?	
^{12}C^j	27595.0	2.4	27595.0	2.4	RQ		0^+ T=2	17					
^{12}N	17338.1	1.0				11.000 ms 0.016	1^+*	17	09Hy01	D	1949	β^+=100;$\beta^+\alpha$=1.93 4	*
^{12}N^i	29580	4	12242	4	2p	> 5 zs	(0^+) T=2	17	MMC142J				*
^{12}O	32013	12				8.9 zs 3.3	0^+	17	19We11	T	1978	2p=100	*
*^{12}Be^m	T : average 07Sh34=229(8) 13Jo06=247(15); other 18Ch31=270(+12-120)												**
*^{12}N	T : from 78Al01; other 20Bi15=10.92(0.11,stat)(0.01,syst)												**
*^{12}N^i	T : from width<100 keV in 19We11												**
*^{12}O	T : from width=51(19) keV in 19We11; others 12Ja11<72 keV												**
*^{12}O	T : 09Su14=600(500) keV 95Kr03=578(205)keV												**
^{13}Li	56980	70				3.3 zs 1.2	$3/2^-$#		08Ak03	D	2008	2n=100	*
^{13}Be	33659	10				1.0 zs 0.7	$(1/2^-)$		19Co02	J	1983	n ?	*
^{13}Be^p	35160	50	1500	50	RQ		$(5/2^+)$				1992		
^{13}B	16561.9	1.0				17.16 ms 0.18	$3/2^-$	00	15Bi05	TD	1956	β^-=100;β^-n=0.266 36	
^{13}C	3125.0093	0.0002				STABLE	$1/2^-$*	01			1929	IS=1.06 6	
^{13}C^i	18233.8	1.1	15108.8	1.1	RQ		$3/2^-$ T=3/2	00				IT=0.82 7;n ?;α ?	
^{13}N	5345.48	0.27				9.965 m 0.004	$1/2^-$*	00			1934	β^+=100	
^{13}N^i	20410.59	0.18	15065.1	0.3	RQ		$3/2^-$ T=3/2	00				IT=4.9 3;p ?;α ?	
^{13}O	23115	10				8.58 ms 0.05	$(3/2^-)$	00	70Es03	D	1963	β^+=100;β^+p=10.9 2	
^{13}F	42030#	500#					$1/2^+$#					p ?	
*^{13}Li	T : from width=125(60-40) keV in 13Ko03												**
*^{13}Be	T : from width=450(30) keV in 10Ko17; other width=300(200) keV in 95Pe12												**
*^{13}Be	J : from 10Ko17,19Co02; others J=1/2+ in 01Th01,08Ch07,13Ak02,14Ra07												**
^{14}Be	39950	130				4.53 ms 0.27	0^+	01	15Bi05	TD	1973	β^-=100;β^-n=86 6;β^-2n=5 2; β^-t=0.02 1;$\beta^-\alpha$<0.004	*
^{14}Be^p	41470	60	1520	150	RQ		(2^+)		95Bo10	I	1995		
^{14}B	23664	21				12.36 ms 0.29	2^-	01	15Bi05	TD	1966	β^-=100;β^-n=6.04 23; β^-2n ?	
^{14}B^i	40728	20	17065	29	RQ	4.15 zs 1.9	0^+ T=3		MMC162J		2001	IT ?	*
^{14}C	3019.893	0.004				5.70 ky 0.03	0^+	01			1936	β^-=100	
^{14}C^i	25120	100	22100	100			(2^-) T=2	01			1989	IT=100	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{14}N	2863.4168	0.0002				STABLE			1^+*	01			1920	IS=99.6205 247	
^{14}N^i	5176.007	0.010	2312.590	0.010					0^+ T=1	01	01Ba06	E	1963	IT=100	
^{14}O	8007.781	0.025				70.621	s	0.011	0^+	01	13La23	T	1949	β^+=100	*
^{14}F	31960	40				500	ys	60	2^-	14	10Go16	TJ	2010	p ?	*
*^{14}Be	D : %β^-t, %$\beta^-\alpha$ from 02Je11														**
*^{14}B^i	T : from width=110(50) keV in 01Ta23														**
*^{14}O	T : average 13La23=70.610(0.030),70.632(0.094) 12Ta.B=70.623(0.053)														**
*^{14}O	T : 06Bu06=70.696(0.052) 04Ba78=70.641(0.020) 01Ga59=70.560(0.049)														**
*^{14}O	T : 78Be61=70.684(0.077) 78Wi04=70.613(0.025) 73Cl12=70.588(0.028);														**
*^{14}O	T : others (outweighed): 74Az01=70.43(0.18) 72Al01=70.48(0.15)														**
*^{14}O	T : 72Si50=70.32(0.12)														**
*^{14}F	T : from width=910(100) keV in 10Go16														**
^{15}Be	49830	170				790	ys	270	$(5/2^+)$	15	13Sn02	TD	2013	n=100	*
^{15}B	28957	21				10.18	ms	0.35	$3/2^-$	02	15Bi05	TD	1966	β^-=100;β^-n=98.7 10; β^-2n<1.5	*
^{15}C	9873.1	0.8				2.449	s	0.005	$1/2^+$	02			1950	β^-=100	
^{15}N	101.4381	0.0006				STABLE			$1/2^-*$	02			1929	IS=0.3795 247	
^{15}N^i	11717	4	11615	4	RQ				$1/2^+$ T=3/2	02				n ?;p ?;IT=0.00523 19	
^{15}O	2855.6	0.5				122.266	s	0.043	$1/2^-*$	02	20Bu02	T	1934	β^+=100	*
^{15}O^i	14020#	40#	11165#	35#					$(1/2^+)$ T=3/2	02	Imme	E		p=100	
^{15}F	16567	14				1.1	zs	0.3	$1/2^+$	16	04Go15	J	1978	p=100	*
^{15}Ne	40220	70			2p	770	ys	300	$(3/2^-)$	14	14Wa09	JTD	2014	2p=100	*
*^{15}Be	T : from width=575(200) keV in 13Sn02														**
*^{15}B	D : %β^-2n symmetrized from 91Ha25=99.68(+0.08-1.58); other 95Re.A=93.6(1.2)														**
*^{15}O	T : average 20Bu02=122.308(49) 77Az01=122.23(0.23) 60Ja12=122.1(0.1)														**
*^{15}F	T : from width=370(70)(+200-0) keV in 16De15														**
*^{15}Ne	T : from width=590(230) keV														**
^{16}Be	57450	170				650	ys	130	0^+	15	12Sp01	TD	2012	2n=100	*
^{16}B	37112	25				>4.6	zs		0^-#	16			2000	n ?	
^{16}C	13694	4				750	ms	6	0^+	99			1961	β^-=100;β^-n=99.0 3	*
^{16}N	5683.9	2.3				7.13	s	0.02	2^-	99	18Ki12	D	1933	β^-=100;$\beta^-\alpha$=0.00154 5	*
^{16}N^m	5804.3	2.3	120.42	0.12		5.25	μs	0.06	0^- T=1	99	83Mi20	D	1957	IT≈100;β^-=0.000389 25	*
^{16}N^i	15613	7	9929	7	RQ				0^+ T=2	99					
^{16}O	−4737.0021	0.0003				STABLE			0^+	99			1919	IS=99.757 11	
^{16}O^p	8231.60	0.27	12968.6	0.27					2^-	99	64Bo13	E		p=78 4;α=22 4;IT=0.28 3	
^{16}O^i	8059	4	12796	4	RQ				0^- T=1	99				IT=100	
^{16}O^j	17984	4	22721	4	RQ				0^+ T=2	99					
^{16}F	10675	5				21	zs	5	0^-	99	18Ch25	T	1964	p=100	*
^{16}Ne	23987	20				>5.7	zs		0^+	99	14Br19	T	1977	2p=100	*
*^{16}Be	T : from width=0.8(+0.1-0.2) MeV														**
*^{16}C	T : average 01Gr06=753(8) 76Al02=747(8)														**
*^{16}N	D : %$\beta^-\alpha$ average 18Ki12=0.00159(6) 16Re01=0.00149(5stat)(+0-10sys)														**
*^{16}N^m	D : %β^- average 83Mi20=4.35(0.50)e-4 5.10(0.65)e-4 83Ga18=3.42(0.37)e-4,														**
*^{16}N^m	D : supersedes 82Ga05=3.13(0.43)e-4, 75Pa01=3.3(0.7)e-4														**
*^{16}F	T : from width=21.3(5.1) keV														**
*^{16}Ne	T : from width<80 keV (3 sigma upper limit) in 14Br19														**
^{17}B	43720	200				5.08	ms	0.05	$(3/2^-)$	99	88Du09	D	1973	β^-=100;β^-n=63 1; β^-2n=12 2;β^-3n=3.5 7; β^-4n=0.4 3	*
^{17}C	21032	17				193	ms	6	$3/2^+$	17			1968	β^-=100;β^-n=28.4 13; β^-2n ?	
^{17}N	7870	15				4.173	s	0.004	$1/2^-$	99	94Do08	D	1949	β^-=100;β^-n=95.1 7; $\beta^-\alpha$=0.0025 4	*
^{17}O	−808.7642	0.0006				STABLE			$5/2^+*$	99			1925	IS=0.03835 96	
^{17}O^i	10270.02	0.17	11078.78	0.17	RQ				$1/2^-$ T=3/2	99				β^- ?;n ?;IT=0.42 14	
^{17}F	1951.70	0.25				64.370	s	0.027	$5/2^+$	99	16Br01	T	1934	β^+=100	*
^{17}F^i	13144.7	1.9	11193.0	1.9	RQ				$1/2^-$ T=3/2	99					

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{17}Ne	16500.5	0.4				109.2	ms	0.6	$1/2^-$*	99	02Mo19	D	1963	β^+=100;β^+p=94.4 29; $\beta^+\alpha$=3.51 1;β^+pα=0.014 4	
^{17}Na	34720	60							$(1/2^+)$	17	17Br07	IJD	2017	p=100	
*^{17}N	D : %β^-n from 76Al02														**
*^{17}F	T : average 16Br01=64.402(0.042) 15Gr14=64.347(0.035)														**
^{18}B	51790	200				<26	ns		(2^-)	16	10Sp02	IJ	2010	n=100	
^{18}C	24920	30				92	ms	2	0^+	17			1969	β^-=100;β^-n=31.5 15; β^-2n ?	
^{18}N	13113	19				619.2	ms	1.9	1^-	96	05Li60	TD	1964	β^-=100;β^-n=7.0 15; $\beta^-\alpha$=12.2 6;β^-2n ?	*
^{18}O	−782.8163	0.0006				STABLE			0^+	96			1929	IS=0.2045 102	
^{18}O^i	15495	20	16278	20					1^- T=2	AHWe					*
^{18}F	873.1	0.5				109.734	m	0.008	1^+	96	FGK204	T	1937	β^+=100	
^{18}F^m	1994.5	0.5	1121.36	0.15		162	ns	7	5^+	96				IT=100	
^{18}F^i	1914.7	0.5	1041.55	0.08					0^+ T=1	96				IT=100	
^{18}Ne	5317.6	0.4				1664.20	ms	0.47	0^+	96	15La19	T	1954	β^+=100	*
^{18}Na	25040	90				1.3	zs	0.4	1^-#	15	04Ze05	TD	2004	p=?	
*^{18}N	D : %$\beta^-\alpha$ from 89Zh04														**
*^{18}N	D : other %β^-n 94Sc01=2.2(0.4) 95Re.A=10.9(0.9) 91Re02=14.3(2.0)(same group)														**
*^{18}N	T : average 05Li60=619(2) 99Og03=620(14) 82Ol01=624(12) 64Ch19=630(30)														**
*^{18}O^i	E : assuming 16399(5), 17025(10) levels to be IAS's of 114.90(0.18), 747(10)														**
*^{18}O^i	E : levels in ^{18}N (see 95Ti07)														**
*^{18}Ne	T : average 15La19=1664.00(+0.57-0.48) 13Gr03=1664.8(1.1), supersedes														**
*^{18}Ne	T : 07Gr18=1665.6(1.9); others (outweighed): 75Al27=1669(4) 75Ha21=1687(9)														**
^{19}B	59770	530				2.92	ms	0.13	$(3/2^-)$	18	03Yo02	TD	1984	β^-=100;β^-n=71 9; β^-2n=17 5;β^-3n<9.1	*
^{19}C	32410	100				46.2	ms	2.3	$1/2^+$	17	88Du09	TD	1974	β^-=100;β^-n=47 3;β^-2n=7 3	*
^{19}N	15856	16				336	ms	3	$1/2^-$	96	06Su12	TJD	1968	β^-=100;β^-n=41.8 9	
^{19}O	3332.9	2.6				26.470	s	0.006	$5/2^+$	96	13Uj01	T	1936	β^-=100	*
^{19}F	−1487.4451	0.0008				STABLE			$1/2^+$*	96			1920	IS=100	
^{19}F^i	6052.2	0.9	7539.6	0.9					$5/2^+$ T=3/2	96				IT=100	
^{19}Ne	1752.05	0.16				17.2569	s	0.0019	$1/2^+$*	96	17Fo24	T	1939	β^+=100	*
^{19}Ne^i	9253	9	7501	9	RQ				$(5/2)^+$ T=3/2	96	MMC127J				*
^{19}Na	12929	11				> 1	as		$(5/2^+)$	15	10Mu12	T	1969	p=100	*
^{19}Mg	31840	60				5	ps	3	$1/2^-$#	14	09Mu17	TD	2007	2p=100	*
*^{19}B	D : %β^-n, %β^-2n symmetrized from 03Yo02=71.8(+8.3-9.1), 16.0(+5.6-4.8)														**
*^{19}C	T : average 88Du09=49(4) 95Re.A=44(4) 95Oz02=45.5(4.0)														**
*^{19}C	J : from 01Ma08, 99Na27 and 95Ba28														**
*^{19}O	T : average 13Uj01=26.476(0.009) 94It.A=26.464(0.009)														**
*^{19}Ne	T :average 17Fo24=17.2569(0.0021) 13Uj01=17.254(0.005) 12Tr06=17.262(0.007);														**
*^{19}Ne	T : others (outliers) 14Br06=17.283(0.008) 94Ko.A=17.296(0.005)														**
*^{19}Ne	T : 92Ge08=18.5(0.6) for q=10+ (bare ion)														**
*^{19}Ne^i	J : possible IAS of ^{19}O gs (J=5/2+)														**
*^{19}Na	T : from width<40 keV in 10Mu12, dominated by resolution of <1 eV														**
*^{19}Mg	T : symmetrized from 09Mu17=6(+2-4); supersedes 07Mu15=4.0(1.5)														**
^{20}B	69400	550				> 912.4	ys		$(1^-,2^-)$	19	18Le18	TJ	2018	n=100;β^-n ?;β^-2n ?	*
^{20}C	37500	230				16	ms	3	0^+	17	90Mu06	TD	1981	β^-=100;β^-n=70 11; β^-2n<18.6	*
^{20}N	21770	80				136	ms	3	(2^-)	18	06Su12	TD	1969	β^-=100;β^-n=42.9 14; β^-2n ?	
^{20}O	3796.2	0.9				13.51	s	0.05	0^+	98			1959	β^-=100	
^{20}F	−17.463	0.030				11.0062	s	0.0080	2^+	98	19Bu01	T	1935	β^-=100	*
^{20}F^i	6503	3	6521	3	RQ				0^+ T=2	98					
^{20}Ne	−7041.9322	0.0015				STABLE			0^+	98			1913	IS=90.48 3	
^{20}Ne^i	3230.5	2.0	10272.5	2.0	RQ				2^+ T=1	98				IT=100	
^{20}Ne^j	9690.9	2.8	16732.8	2.8	RQ				0^+ T=2	98				IT=100	
^{20}Na	6850.5	1.1				447.9	ms	2.3	2^+*	98	89Cl02	D	1950	β^+=100;$\beta^+\alpha$=25.0 4	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{20}Na^{i}	13348.9	1.2	6498.4	0.5	p				0^+ T=2	98			1979	p=100	
^{20}Mg	17477.7	1.9				90.4	ms	0.5	0^+	16	17Su05	T	1974	β^+=100;β^+p=30.3 12	*
*^{20}B	T : from width < 0.5 MeV														**
*^{20}C	D : %β^-n average 03Yo02=65(+19-18) 90Mu06=72(14)														**
*^{20}C	T : average 90Mu06=14(+6-5), supersedes 89Le16=16(+14-7) same group,														**
*^{20}C	T : 95Re.A=16.7(3.5); other 03Yo02=21.8(+15.0-7.4)														**
*^{20}F	T : evaluated in 19Bu01 using the world data														**
*^{20}Mg	T : average 17Su05=90.0(0.6) 16Lu13=91.4(1.0)														**
^{21}B	78380	560				> 760	ys		$(3/2^-)$	19	18Le18	TJI	2018	2n=100	*
^{21}C	45640#	600#				<30ns			$1/2^+$#	15	93Po.A	I		n ?	
^{21}N	25230	130				85	ms	5	$(1/2^-)$	15	09Li51	TD	1970	β^-=100;β^-n=87 3;β^-2n ?	*
^{21}O	8062	12				3.42	s	0.10	$(5/2^+)$	15			1968	β^-=100;β^-n ?	
^{21}F	−47.6	1.8				4.158	s	0.020	$5/2^+$	15			1955	β^-=100	
^{21}Ne	−5731.78	0.04				STABLE			$3/2^+$*	15			1928	IS=0.27 1	
^{21}Ne^{i}	3129.0	0.3	8860.8	0.3					$5/2^+$ T=3/2	15					
^{21}Na	−2184.86	0.04				22.4550	s	0.0054	$3/2^+$*	15	18Sh27	T	1940	β^+=100	*
^{21}Na^{i}	6790	4	8975	4	p				$5/2^+$ T=3/2	15					
^{21}Mg	10903.9	0.8				120.0	ms	0.4	$5/2^+$*	15	15Lu13	D	1963	β^+=100;β^+p=20.1 21; $\beta^+\alpha$=0.116 18; β^+pα=0.016 3	
^{21}Al	27090#	600#				<35ns			$5/2^+$#	15	93Po.A	I		p ?	
*^{21}B	T : from width < 0.6 MeV														**
*^{21}N	T : average 09Li51=83(8), supersedes 08Lo06=82.9(1.9), 07Su05=85(14)														**
*^{21}N	T : 90Mu06=95(+15-11) 95Re.A=83.6(6.7), supersedes 91Re02=61(23)														**
*^{21}N	D : %β^-n average 09Li51=90.5(4.2) 90Mu06=84(9) 95Re.A=78(7), supersedes														**
*^{21}N	D : 91Re02=76(15)														**
*^{21}Na	T : average 18Sh27=22.4615(0.0040) 17Fi07=22.4056(0.0033); others														**
*^{21}Na	T : 15Gr05=22.422(0.010) 75Az01=22.47(0.03) 74Al03=22.55(0.10)														**
*^{21}Mg	T : average 15Lu12=118.6(0.5) 18Wa20=121.9(0.6) 92Go10=120(5)														**
*^{21}Mg	T : 73Se08=123(3) 65Ha20=121(5)														**
*^{21}Mg	D : %β^+p average 18Wa20=19.2(30) 15Lu13=21.0(3.0)														**
^{22}C	53610	230				6.2	ms	1.3	0^+	15	03Yo02	TD	1986	β^-=100;β^-n=61 14;β^-2n<37	*
^{22}N	31760	210				23	ms	3	0^-#	15			1979	β^-=100;β^-n=34 3; β^-2n=12 3	
^{22}O	9280	60				2.25	s	0.09	0^+	15			1969	β^-=100;β^-n<22	
^{22}F	2793	12				4.23	s	0.04	(4^+)	15			1965	β^-=100;β^-n<11	
^{22}Ne	−8024.716	0.018				STABLE			0^+	15			1913	IS=9.25 3	
^{22}Ne^{i}	5855	10	13880	10					4^+ T=2	15	04Go03	E			*
^{22}Na	−5181.39	0.13				2.6019	y	0.0006	3^+*	15	FGK204	T	1935	β^+=100;e$^+$=90.57 8; ε=9.43 6	*
^{22}Na^{m}	−4598.34	0.16	583.05	0.10		243	ns	2	1^+	15			1958	IT=100	
^{22}Na^{i}	−4524.39	0.19	657.00	0.14		19.6	ps	0.7	0^+ T=1	15				IT=100	
^{22}Mg	−399.99	0.16				3.8745	s	0.0007	0^+	15	17Du11	T	1961	β^+=100	*
^{22}Mg^{i}	13644	6	14044	6	p				$(4)^+$ T=2	15	MMC12	J		α=?;p=?	*
^{22}Al	18200#	400#				91.1	ms	0.5	$(4)^+$	15			1982	β^+=100;β^+p=55 3; β^+2p=1.10 11; $\beta^+\alpha$=0.038 17	*
^{22}Si	33640#	500#				28.7	ms	1.1	0^+	15	20Le16	TD	1987	β^+=100;β^+p=62 5; β^+2p=0.7 3	*
*^{22}C	T : symmetrized from 03Yo02=6.1(+1.4-1.2)														**
*^{22}C	D : %β^-n symmetrized from 03Yo02=61(+14-13)														**
*^{22}Ne^{i}	E : from 16Ma.A, but T=2 assignment is not firm														**
*^{22}Na	D : from 71GoYM														**
*^{22}Mg	T : average 17Du11=3.87400(0.00079) 03Ha20=3.8755(0.0012)														**
*^{22}Mg^{i}	J : IAS of ^{22}Al gs [J=(4)+]														**
*^{22}Si	T : average 20Le16=28.6(1.4), supersedes 17Xu01=27.8(3.5), 96Bl11=29(2)														**
*^{22}Si	D : %β^+p from 20Le16, based on %I(p)=5.3(1.0), 43.0(4.6) and 13.5(2.1);														**
*^{22}Si	D : %β^+2p from 17Xu01														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{23}C	64170#	1000#							$3/2^+$#					n ?	
^{23}N	36720	420				13.9	ms	1.4	$1/2^-$#	21	03Yo02	TD	1985	β^-=100;β^-n=42 6;β^-2n=8 4;β^-3n<3.4	*
^{23}O	14620	120				97	ms	8	$1/2^+$	21	07Su05	TD	1970	β^-=100;β^-n=7 2	
^{23}F	3290	30				2.23	s	0.14	$5/2^+$	21	95Re.A	D	1970	β^-=100;β^-n<14	
^{23}Ne	−5154.05	0.10				37.15	s	0.03	$5/2^+$*	21	15La19	T	1936	β^-=100	*
^{23}Na	−9529.8535	0.0018				STABLE			$3/2^+$*	21			1921	IS=100	*
^{23}Na^i	−1638.7	0.3	7891.2	0.3					$5/2^+$ T=3/2	21				IT=100	
^{23}Na^j	10060.6	2.0	19590.4	2.0		240	zs	120	T=5/2	21	85Ev01	T			*
^{23}Mg	−5473.67	0.03				11.3039	s	0.0032	$3/2^+$*	21	17Yo05	J	1939	β^+=100	
^{23}Mg^i	2329.3	0.6	7803.0	0.6					$5/2^+$ T=3/2	21	00Pe28	D	1981	IT≈100;p=0.17 8	
^{23}Al	6748.1	0.3				446	ms	6	$5/2^+$	21	06Ia03	T	1969	β^+=100;β^+p=1.22 5	*
^{23}Al^i	18470	40	11720	40	p				$(5/2)^+$ T=5/2	21			1997	p=0.10 5;2p=3.6 4	
^{23}Si	23950#	500#				42.3	ms	0.4	$3/2^+$#	21	97Bl04	TD	1986	β^+=100;β^+p≈88;β^+2p=3.6 3	*
*^{23}N	T : symmetrized from 03Yo02=14.1(+1.2-1.5)														**
*^{23}N	D : %β^-n and %β^-2n symmetrized from 03Yo02=42.2(+6.3-6.5) and 8.0(+3.8-3.4)														**
*^{23}Ne	T : average 15La19=37.148(0.032) 07Gr18=37.11(0.06) 74Al03=37.24(0.12)														**
*^{23}Na	J : 00Ke09=5/2														**
*^{23}Na^j	T : from width=1.9(0.8) keV														**
*^{23}Mg	T : average 77Az01=11.317(0.011) 17Ma18=11.3027(0.0033)														**
*^{23}Al	D : from 11Sa15														**
*^{23}Si	T : also 18Wa05=40.17(1.86) for all delayed proton event > 300 keV														**
^{24}N	46940#	400#				<52ns				07	93Po.A	I		n ?	
^{24}O	18500	160				77.4	ms	4.5	0^+	07	15Ca09	TD	1970	β^-=100;β^-n=43 4	*
^{24}F	7540	100				384	ms	16	3^+	07	07Su05	T	1970	β^-=100;β^-n<5.9	*
^{24}Ne	−5951.6	0.5				3.38	m	0.02	0^+	07			1956	β^-=100[gs=0,m=100]	
^{24}Na	−8417.901	0.017				14.9560	h	0.0015	4^+*	07	FGK204	T	1934	β^-=100	*
^{24}Na^m	−7945.694	0.017	472.2074	0.0008		20.18	ms	0.10	1^+	07			1961	IT≈100;β^-=0.05	
^{24}Na^i	−2450.53	0.13	5967.37	0.13					0^+ T=2	07					
^{24}Mg	−13933.578	0.013				STABLE			0^+	07			1920	IS=78.965 49	
^{24}Mg^i	−4417.30	0.04	9516.28	0.04					(4^+) T=1	07					
^{24}Mg^j	1502.8	0.6	15436.4	0.6					0^+ T=2	07					
^{24}Al	−48.81	0.23				2.053	s	0.004	4^+	07			1953	β^+=100;$\beta^+\alpha$=0.035 6;β^+p=0.0016 3	
^{24}Al^m	376.99	0.25	425.8	0.1		130	ms	3	1^+	07			1968	IT=82.5 30;β^+=17.5 30;$\beta^+\alpha$=0.028 6	
^{24}Al^i	5900	3	5949	3	p				0^+ T=2	07					
^{24}Si	10745	19				143.2	ms	2.1	0^+	07	15Su15	T	1979	β^+=100;β^+p=34.5 14	*
^{24}P	34020#	500#							1^+#					p ?;β^+ ?;β^+p ?	
*^{24}O	T : average 15Ca09=80(5) 01Pe14=67(10); other 90Mu06=61(+32-19)														**
*^{24}F	J : 15Ca09=3														**
*^{24}Na	J : 00Ke09=4														**
*^{24}Si	T : average 15Su15=143.3(2.2) 97Cz02=140(8)														**
*^{24}Si	D : %β^+p average 98Cz01= 37.6(2.5) 11Ic06=33.3(1.6)														**
^{25}N	55980#	500#				<260ns			$1/2^-$#	09	99Sa06	I		n ?;2n ?;β^- ?	*
^{25}O	27330	170				5.18	zs	0.35	$3/2^+$#	09	16Ko11	T	2008	n=100	*
^{25}F	11330	100				80	ms	9	$(5/2^+)$	09			1970	β^-=100;β^-n=23.1 45;β^-2n ?	
^{25}Ne	−2036	29				602	ms	8	$1/2^+$*	09			1970	β^-=100	
^{25}Na	−9357.8	1.2				59.1	s	0.6	$5/2^+$*	09			1943	β^-=100	*
^{25}Mg	−13192.78	0.05				STABLE			$5/2^+$*	09			1920	IS=10.011 13	*
^{25}Mg^i	−5405.8	0.3	7787.0	0.3					$5/2^+$ T=3/2	09					
^{25}Al	−8915.97	0.06				7.1666	s	0.0023	$5/2^+$	09	17Lo09	T	1953	β^+=100	*
^{25}Al^i	−1014.9	1.8	7901.1	1.8					$5/2^+$ T=3/2	09	20Su.1	E			
^{25}Si	3827	10				220.6	ms	1.0	$5/2^+$	09	20Su.1	T	1963	β^+=100;β^+p=35 2	*
^{25}P	20190#	400#				<30ns			$1/2^+$#	09	93Po.A	I		p ?	
*^{25}N	I : 240 ^{25}N events expected, but none observed in 99Sa06														**
*^{25}O	T : from width=88(6) keV in 16Ko11; other width=20(+60-20) keV in 13Ca18														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{25}Na J : 00Ke09=5/2 **
*^{25}Mg J : also 17Yo05,19Yo06=5/2 **
*^{25}Al T : average 17Lo09=7.1657(0.0024) 75Az01=7.174(0.007) **
*^{25}Si T : symmetrized from 20Su.1=220.9(+0.8-1.2) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{26}O	34660	160				4.2	ps	3.3	0^+	16	13Ko10	T	2012	2n=100	*
^{26}F	18670	110				8.2	ms	0.9	1^+	16			1979	β^-=100;β^-n=13.5 40; β^-2n ?	
^{26}F^m	19310	110	643.4	0.1		2.2	ms	0.1	(4^+)	16			2013	IT=82 11;β^-=?;β^-n=12 8	
^{26}Ne	481	18				197	ms	2	0^+	16			1970	β^-=100;β^-n=0.13 3	
^{26}Na	−6861	4				1071.28	ms	0.25	3^+*	16			1958	β^-=100	*
^{26}Na^m	−6779	4	82.4	0.04		4.35	μs	0.16	1^+	16	14NiZZ	ET	1987	IT=100	*
^{26}Mg	−16214.544	0.029				STABLE			0^+	16			1920	IS=11.025 38	
^{26}Al	−12210.14	0.07				717	ky	24	5^+	16			1934	β^+=100	
^{26}Al^m	−11981.83	0.07	228.306	0.013	MD	6346.0	ms	0.5	0^+ T=1	16	13Ch51	T	1934	β^+=100	*
^{26}Si	−7141.00	0.11				2.2453	s	0.0007	0^+	16	10Ia01	T	1960	β^+=100	*
^{26}Si^i	5874	4	13015	4	p				(3^+) T=2	16					
^{26}P	10970#	200#				43.6	ms	0.3	$(3)^+$	16	17Ja05	D	1983	β^+=100;β^+p=35.1 14; β^+2p=1.99 21	*
^{26}P^m	11130#	200#	164.4	0.1		115	ns	8	(1^+)	16	17Pe09	ET	2014	IT=100	*
^{26}S	27680#	600#				<79ns			0^+	16	11Fo08	IT		2p ?	

*^{26}O T : symmetrized from 13Ko10=4.5(+1.1-1.5 stat)(3 syst) **
*^{26}Na J : 00Ke09=1 **
*^{26}Na^m T : also 87DuZU=9(2) **
*^{26}Al^m T : average 13Ch51=6345.30(0.90) 11Fi01=6346.54(0.46,stat)(0.60,syst) **
*^{26}Al^m T : 11Sc22=6347.8(2.5) 83Ko22=6346.2(2.6) 77Al11=6339.5(4.5) **
*^{26}Al^m T : 75Az01=6346(5) 72Ha82=6351(10) 69Fr08=6346(5) **
*^{26}Si T : other 08Ma39=2.2283(0.0027), discrepant; see discussions in 10Ia01 **
*^{26}P D : %β^+2p average 17Ja05=1.5(0.4) 04Th09=2.16(0.24); **
*^{26}P D : %β^+p + %β^+2p average 17Ja05=35(2) 04Th09=39(2) **
*^{26}P T : average 20Li06=43.6(0.3) 07Th09=43.7(0.6); **
*^{26}P T : others: 17Ja05=50(+23-12) 83Ca06,84Ca29=20(+35-15) **
*^{26}P^m T : average 14NiZZ=120(9) 17Pe09=104(14) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{27}O	44670#	500#				<260ns			$3/2^+$#		99Sa06	I		n ?;2n ?	
^{27}F	25130	120				5.0	ms	0.2	$5/2^+$#	11			1981	β^-=100;β^-n=77 21;β^-2n ?	*
^{27}Ne	7050	90				30.9	ms	1.1	$(3/2^+)$	11	17Ha23	T	1977	β^-=100;β^-n=2.0 5;β^-2n ?	*
^{27}Na	−5518	4				301	ms	6	$5/2^+$*	11			1968	β^-=100;β^-n=0.098 24	*
^{27}Mg	−14586.59	0.05				9.435	m	0.027	$1/2^+$*	11	15ZaZY	T	1934	β^-=100	*
^{27}Al	−17196.86	0.05				STABLE			$5/2^+$*	11			1922	IS=100	
^{27}Al^i	−10383.1	0.7	6813.8	0.7					$1/2^+$ T=3/2	11				IT=100	
^{27}Si	−12384.51	0.11				4.117	s	0.014	$5/2^+$	11	17Ma18	T	1939	β^+=100	*
^{27}Si^i	−5759.5	2.3	6625.0	2.3	RQ				$1/2^+$ T=3/2	11			1977	IT ?	
^{27}P	−659	9				260	ms	80	$1/2^+$	11			1977	β^+=100;β^+p≈0.07	
^{27}P^i	12010	30	12670	30	p				$5/2^+$ T=5/2	11			1991	IT ?	
^{27}S	17490#	400#				16.3	ms	0.2	$(5/2^+)$	11	19Su14	T	1986	β^+=100;β^+p=61 3; β^+2p=3.0 6	*

*^{27}F T : average 99Re16=6.5(1.1) 97Ta22=5.3(0.9) 99Dl01=5.2(0.3) 98NoZW=4.9(0.2) **
*^{27}F D : %β^-n symmetrized from 99Re16=90(+10-30) **
*^{27}Ne T : average 17Ha23=29.3(2.1) 06Tr02=31.5(1.3) **
*^{27}Na J : 00Ke09=5/2 **
*^{27}Na D : %β^-n average 84Gu19=0.13(0.04) 74Ro31=0.08(0.03) **
*^{27}Mg T : average 15ZaZY=9.408 (0.012) 70Re13=9.462 (0.012); Birge ratio=3.18 **
*^{27}Si T : average 17Ma18=4.1117(0.0020) 75Az01=4.109 (0.004) 76Ge06=4.206(0.008); **
*^{27}Si T : Birge ratio=8.19 **
*^{27}S T : others 17Ja05=15.5(1.6) 01Ca60=15.5(1.5) **
*^{27}S D : %β^+p deduced from %β^+p + %β^+2p = 64(3) and %β^+2p=3.0(0.6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{28}O	52080#	700#				<100ns			0^+	13	98Po.A	I		2n ?;β^-=0	*
^{28}F	33400	120				46	zs		(4^-)	13	20Re06	JD	2012	n=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{28}Ne	11300	130				18.8	ms	0.2	0^+	13	17Ha23	T	1979	β^-=100;β^-n=12 1; β^-2n=3.7 5	*
^{28}Na	−988	10				33.1	ms	1.3	1^+*	13	17Ha23	T	1969	β^-=100;β^-n=0.58 12	*
^{28}Mg	−15019.95	0.26				20.915	h	0.009	0^+	13			1953	β^-=100	
^{28}Al	−16850.72	0.05				2.245	m	0.005	3^+*	13	20He.A	J	1934	β^-=100	
^{28}Al^i	−10858.14	0.11	5992.58	0.10					0^+ T=2	13					
^{28}Si	−21492.7971	0.0005				STABLE			0^+	13			1920	IS=92.2545 37	
^{28}Si^r	−8951.75	0.05	12541.04	0.05	RQ				(3^+)	13					
^{28}Si^i	−12176.88	0.10	9315.92	0.10		1.5	fs	0.6	3^+ T=1	13					
^{28}Si^j	−6265.8	1.0	15227	1					(0^+) T=2	13	68Mc12	D	1968	α=90 11;p=10 11	
^{28}P	−7147.9	1.1				270.3	ms	0.5	3^+	13	79Ho27	D	1953	β^+=100;β^+p=0.0013 4; $\beta^+\alpha$=0.00086 25	
^{28}P^i	−1261	20	5887	20	p				0^+ T=2	13					
^{28}S	4070	160				125	ms	10	0^+	13			1982	β^+=100;β^+p=20.7 19	
^{28}Cl	28270#	500#				>100ns			1^+#		18Mu18	TD	2018	p=100	

*^{28}O I : also 11 and 37 ^{28}O events expected in 97Ta22 and 99Sa06, **
*^{28}O I : respectively, but none observed **
*^{28}Ne T : average 17Ha23=19.2(0.6) 15Le17=18.6(0.2) 06Tr02=20.0(0.5) **
*^{28}Na T : unweighted average 17Ha23=34.6(1.0) 84Gu19=34.1(0.6) 74Ro31=30.5(0.4); **
*^{28}Na T : Birge ratio=4.06 **
*^{28}Na J : 00Ke09=1 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{29}F	40150	530				2.5	ms	0.3	$(5/2^+)$	12	17Ma77	J	1989	β^-=100;β^-n=60 40;β^-2n ?	*
^{29}Ne	18400	150				14.7	ms	0.4	$(3/2^-)$	12	05Tr13	T	1985	β^-=100;β^-n=28 5;β^-2n=4 1	*
^{29}Na	2680	7				43.2	ms	0.4	$3/2^+$*	12	17Ha23	T	1969	β^-=100;β^-n=22 3;β^-2n ?	*
^{29}Mg	−10612.4	0.3				1.30	s	0.12	$3/2^+$*	12			1971	β^-=100	*
^{29}Al	−18207.8	0.3				6.56	m	0.06	$5/2^+$*	12	20He.A	J	1939	β^-=100	
^{29}Si	−21895.0815	0.0006				STABLE			$1/2^+$*	12			1920	IS=4.672 16	
^{29}Si^i	−13605	5	8290	5					$5/2^+$ T=3/2	12				IT=100	
^{29}P	−16952.8	0.4				4.102	s	0.004	$1/2^+$	12	20Lo01	T	1941	β^+=100	*
^{29}P^i	−8571.0	2.5	8381.8	2.4	RQ				$5/2^+$ T=3/2	12			1969	IT=100	
^{29}S	−3094	13				188	ms	4	$5/2^+$#	12	79Vi01	D	1964	β^+=100;β^+p=46.4 10	
^{29}Cl	14020#	190#				5.4	zs	1.9	$(1/2^+)$	16	15Mu13	I	1993	p=100	*
^{29}Ar	37970#	440#				>100ns			$5/2^+$#		18Mu18	TD	2018	2p=100	

*^{29}F D : %β^-n from 99Dl01,01Pe14=100(80) **
*^{29}Ne T : average 05Tr13=13.8(0.5) 06Tr02=15.1(2.6) 97No.A=15.6(0.5); others: **
*^{29}Ne T : 06Tr02=16.4(1.3) 01Pe14=15(3) 99Dl01=15(4) 99Re16=19(9) 97Ta22=15(3) **
*^{29}Ne J : 16Ko05=(3/2) **
*^{29}Ne D : %β^-n average 06Tr02=29(7) 99Re16,99Dl01=27(9) 01Pe14=27(9); **
*^{29}Ne D : other 01Be53=17 5 **
*^{29}Na D : %β^-n average 95Re.A=27.1(1.6) 84La03=21.5(3.0) 74Ro31=15.1(1.8) **
*^{29}Na D : 79De02=21(4); Birge ratio=2.88 **
*^{29}Na T : average 17Ha23=42.8(0.5) 84Gu19=44.9(1.2) 84La03=44(1) 74Ro31=42.9(1.5) **
*^{29}Na J : 00Ke09=3/2 **
*^{29}Mg J : also 19Yo06=5/2 **
*^{29}P T : average 20Lo01=4.1055(0.0044) 80Wi13=4.084(0.022) 75Az01=4.083(0.012); **
*^{29}P T : other (not used) 73Ta04=4.149(0.005) **
*^{29}Cl T : from width=85(30) keV in 16Go.1 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{30}F	48960#	500#				<260ns				10	99Sa06	I		n ?	
^{30}Ne	23280	250				7.22	ms	0.18	0^+	10	15St14	T	1985	β^-=100;β^-n=13 4; β^-2n=8.9 23	*
^{30}Na	8475	5				45.9	ms	0.7	2^+*	10	17Ha23	T	1969	β^-=100;β^-n=28.6 22; β^-2n=1.24 19; $\beta^-\alpha$=5.5e-5 2	*
^{30}Mg	−8881.4	1.3				317	ms	4	0^+	10	84La03	D	1971	β^-=100;β^-n<0.06	*
^{30}Al	−15864.1	1.9				3.62	s	0.06	3^+*	10	20He.A	J	1961	β^-=100	
^{30}Si	−24432.962	0.022				STABLE			0^+	10			1924	IS=3.0735 21	
^{30}P	−20200.86	0.07				2.5000	m	0.0017	1^+* T=0	10	18Ia01	T	1934	β^+=100	*
^{30}P^i	−19523.85	0.08	677.01	0.03					0^+ T=1	10					
^{30}S	−14059.25	0.21				1.1798	s	0.0003	0^+	10	18Ia01	T	1961	β^+=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{30}Cl	4675	24					>100ns	3+#	10	18Mu18	TD	2018	p=100	
^{30}Ar	22070#	180#				< 10 ps		0+	16	15Mu13	IDT	2015	2p=100	
*^{30}Ne	T : average 15St14=7.18(0.22) 07Tr08=7.3(0.3);													**
*^{30}Ne	T : others 01Pe14=7(2) 99Dl01=7.5(1.5)													**
*^{30}Na	T : average 17Ha23=44.1(0.8) 84La02=48(2) 84Gu19=50(3) 79De02=53(3)													**
*^{30}Na	T : 74Ro01=53(3) 99Dl01=50(4) 97Ta22=48(5)													**
*^{30}Na	J : 00Ke09=2													**
*^{30}Na	D : Pn=32.2(2.6), average 84La03=33(5) 84Gu19=30(5) 74Ro01=33.1(3.8);													**
*^{30}Na	D : %β^-2n average 80De26=1.15(0.25) and 1.35(28), from Pn=32.2(2.6) and													**
*^{30}Na	D : P2n/Pn=0.042(0.008) in 80De26. %β^-n average 79De02=26(4) and 29.7(2.6)													**
*^{30}Na	D : from Pn-2*β^-2n=32.2(2.6)-2*1.24(0.19); %$\beta^-\alpha$ from 83De23													**
*^{30}Mg	T : average 17Ha23=311(8) 16Ol06=335(10) 08Hi05=314(5)													**
*^{30}P	T : average 18Ia01=2.501(0.002) 80Wi13=2.498(0.004) 63Mc02=2.497(0.005)													**
*^{30}S	T : average 18Ia01=1.17992(0.00034) 11So11 = 1.1759(0.0017)													**
^{31}F	56840#	540#				2# ms	>260ns	5/2+#	13	99Sa06	I	1999	β^- ?;β^-n ?;β^-2n ?	
^{31}Ne	31180	270				3.4 ms	0.8	(3/2−)	13			1996	β^-=100;β^-n ?;β^-2n ?	
^{31}Na	12246	14				16.8 ms	0.3	3/2+*	13	19Ni04	D	1969	β^-=100;β^-n=36.0 35; β^-2n=0.73 9;β^-3n<0.05	*
^{31}Mg	−3122	3				270 ms	2	1/2+*	13	17Ha23	T	1977	β^-=100;β^-n=6.2 19	*
^{31}Al	−14950.7	2.2				644 ms	25	5/2+*	13	16He09	J	1971	β^-=100;β^-n<1.6	*
^{31}Si	−22949.04	0.04				157.16 m	0.20	3/2+	13	17Da28	T	1934	β^-=100	*
^{31}P	−24440.5444	0.0007				STABLE		1/2+*	13			1920	IS=100	
^{31}P^{i}	−18059.7	2.0	6380.8	2.0				3/2+ T=3/2	13				IT=100	
^{31}S	−19042.53	0.23				2.5534 s	0.0018	1/2+	13			1940	β^+=100	
^{31}S^{i}	−12761.9	0.6	6280.60	0.60				3/2+ T=3/2	13					
^{31}Cl	−7035	3				190 ms	1	3/2+	13			1977	β^+=100;β^+p=2.4 2	
^{31}Cl^{i}	5256	3	12291	5	RQ			3/2+ T=5/2						
^{31}Ar	11330#	200#				15.0 ms	0.3	5/2+*	13	14Ko17	T	1986	β^+=100;β^+p=68.3 3; β^+2p=9.0 2;β^+pα<0.38; β^+3p=0.07 2;$\beta^+\alpha$<0.03; 2p<0.0006	*
^{31}K	34260#	300#				> 10 ps		3/2+#		19Ko18	IT	2019	3p=100	
*^{31}Na	D : %β^-2n average 19Ni04=0.7(0.1) and 0.86(0.20) from Pn=37.5(3.5), average													**
*^{31}Na	D : of 74Ro31=30(8) 84La03=38(6) 19Ni04=40(5), and P2n/Pn=0.023(0.005)													**
*^{31}Na	D : in 80De26. %β^-n from Pn-2*P2n=37.5(3.5)-2*0.73(0.09). P3n from 84Gu19													**
*^{31}Na	T : average 17Ha23=16.6(0.4) 84La03=17.0(0.4) 74Ro31=16.9(0.7) 01Pe14=18(2)													**
*^{31}Na	J : 00Ke09=3/2													**
*^{31}Mg	D : %β^-n strongly conflicting with earlier 84La03=1.7(0.3)													**
*^{31}Al	J : 20He.A,16He09=5/2													**
*^{31}Si	T : other 89Ab05=157.474(0.012), the small uncertainty is not justified													**
*^{31}Ar	T : average 14Ko17=15.1(0.3) 00Fy01=14.1(0.7) 92Ba01=15.1(+1.3-1.1)													**
^{32}Ne	37000#	500#				3.5 ms	0.9	0+	11			1990	β^-=100;β^-n ?;β^-2n ?	
^{32}Na	18640	40				12.9 ms	0.3	(3−)	11	08Tr04	TJ	1972	β^-=100;β^-n=26 6; β^-2n=7.6 15	*
^{32}Mg	−829	3				80.4 ms	0.4	0+	11	17Ha23	T	1977	β^-=100;β^-n=5.5 5	
^{32}Al	−11099	7				32.6 ms	0.5	1+*	11	17Ha23	T	1971	β^-=100;β^-n=0.7 5	*
^{32}Al^{m}	−10142	7	956.6	0.5		200 ns	20	(4+)	11			1996	IT=100	
^{32}Si	−24077.69	0.30				157 y	7	0+	20			1953	β^-=100	
^{32}P	−24304.88	0.04				14.269 d	0.007	1+*	11	FGK204	T	1934	β^-=100	
^{32}P^{i}	−19232.44	0.07	5072.44	0.06				0+ T=2	11				IT=100	
^{32}S	−26015.5371	0.0013				STABLE		0+	11			1920	IS=94.85 255	
^{32}S^{i}	−19014.1	0.4	7001.4	0.4				1+ T=1	11				IT=100	
^{32}S^{j}	−13967.58	0.28	12047.96	0.28				0+ T=2	11				IT=100	
^{32}Cl	−13334.7	0.6				298 ms	1	1+	11			1953	β^+=100;$\beta^+\alpha$=0.054 8; β^+p=0.026 5	
^{32}Cl^{i}	−8288.4	0.7	5046.3	0.3				0+ T=2	11				IT=100	
^{32}Ar	−2200.4	1.8				98 ms	2	0+	11			1977	β^+=100;β^+p=35.58 22	
^{32}K	21990#	400#						1+#					p ?	
^{32}K^{m}	22940#	410#	950#	100#				4+#		Mirror	I		p ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{32}$Na	T : average 08Tr04=13.1(0.5) and 11.5(1.2) 84La03=13.2(0.4) 98No.A=11.5(0.8)														**
$*^{32}$Na	D : %β^-n average 84Gu19=32(13) 84La03=24(7), from Pn=39(6) and														**
$*^{32}$Na	D : %β^-2n=7.6(1.5); other 80De26=10(4); %β^-2n average 84Gu19=8(3)														**
$*^{32}$Na	D : 84La03=9.4(2.4) 80De26=5.5(2.5)														**
$*^{32}$Al	T : average 17Ha23=31.7(0.3) 05Ue01=33.0(0.2); Birge ratio=3.6														**
$*^{32}$Al	J : 18Xu05,20He.A=1														**
^{33}Ne	46130#	600#				<260ns			$7/2^-$#	11	02No11	I		n ?	*
^{33}Na	23780	450				8.2	ms	0.4	$(3/2^+)$	11			1972	β^-=100;β^-n=47 6; β^-2n=13 3	
^{33}Mg	4962.9	2.7				92.0	ms	1.2	$3/2^-*$	11	17Ha23	T	1979	β^-=100;β^-n=14 2;β^-2n ?	*
^{33}Al	−8497	7				41.46	ms	0.09	$5/2^+*$	11	16He09	J	1971	β^-=100;β^-n=8.5 7	*
^{33}Si	−20514.3	0.7				6.18	s	0.18	$3/2^+*$	11			1971	β^-=100	
^{33}P	−26337.4	1.1				25.35	d	0.11	$1/2^+$	20			1951	β^-=100	
^{33}S	−26585.8583	0.0013				STABLE			$3/2^+$	11			1926	IS=0.763 20	
^{33}S^i	−21106.07	0.13	5479.79	0.13					$1/2^+$ T=3/2	11				IT=100	
^{33}Cl	−21003.3	0.4				2.5038	s	0.0022	$3/2^+$	11	15Gr14	T	1940	β^+=100	
^{33}Cl^i	−15454.9	0.5	5548.4	0.4	RQ				$1/2^+$ T=3/2	11				IT=100	
^{33}Ar	−9384.3	0.4				173.0	ms	2.0	$1/2^+$	11	10Ad03	D	1964	β^+=100;β^+p=38.7 8	*
^{33}K	7540#	200#				<25ns			$3/2^+$#	11	93Po.A	I		p ?	
^{33}Ca	31030#	400#							$5/2^+$#					p ?	
$*^{33}$Ne	T : estimated partial β^- decay half-life of 1# ms														**
$*^{33}$Ne	I : also 02Le.A < 1.5 us														**
$*^{33}$Mg	T : average 17Ha23=93.9(1.8) 02Mo29=90.5(1.6); other 84La03=90(20)														**
$*^{33}$Mg	J : also 19Yo06=3/2														**
$*^{33}$Al	T : average 17Ha23=41.4(0.1) 02Mo29=41.7(0.2); also 95Re.A=40.5(2.8)														**
$*^{33}$Ar	D : %β^+p average 10Ad03=38.8(1.3) 87Bo21=38.7(1.0)														**
^{34}Ne	52840#	510#				2#	ms	>1.5us	0^+	12	02Le.A	I	2002	β^- ?;β^-2n ?;β^-n ?	
^{34}Na	31680	600				5.5	ms	1.0	1^+	12	GAu03	D	1983	β^-=100;β^-2n≈50;β^-n≈15	*
^{34}Mg	8323	7				44.9	ms	0.4	0^+	12	17Li03	TD	1979	β^-=100;β^-n=21 7;β^-2n<0.1	
^{34}Al	−2997.6	2.1				53.73	ms	0.13	4^-	12	19Li41	T	1977	β^-=100;β^-n=26 4;β^-2n ?	
^{34}Al^m	−2951.1	2.1	46.47	0.17		22.1	ms	0.2	1^+*		19Li41	TD	2012	β^-≈100;β^-n=11 4;β^-2n ?	*
^{34}Si	−19991.7	0.8				2.77	s	0.20	0^+	12			1971	β^-=100	
^{34}Si^m	−15735.6	0.9	4256.1	0.4		< 210	ns		(3^-)	12			1989	IT=100	
^{34}P	−24548.7	0.8				12.43	s	0.10	1^+	12			1945	β^-=100	
^{34}S	−29931.69	0.04				STABLE			0^+	12			1926	IS=4.365 235	
^{34}Cl	−24440.09	0.05				1.5267	s	0.0004	0^+ T=1	12	06Ia05	T	1934	β^+=100	*
^{34}Cl^m	−24293.73	0.05	146.360	0.027	MD	31.99	m	0.03	3^+ T=0	12			1965	β^+=55.4 6;IT=44.6 6	
^{34}Ar	−18378.29	0.08				846.46	ms	0.35	0^+	12	20Ia01	T	1966	β^+=100	*
^{34}Ar^i	−10444	5	7934	5	RQ				1^+# T=2	12			1969	IT ?	
^{34}K	−1220#	200#				<40ns			1^+#	12	93Po.A	I		p ?	
^{34}Ca	14890#	300#				<35ns			0^+	12	93Po.A	I		2p ?	
$*^{34}$Na	D : %β^-n, %β^-2n estimated from Pn = β^-n + 2*β^-2n = 115(20)% in 84La03														**
$*^{34}$Na	D : by assuming β^-n/β^-2n=0.3 from trends in neighboring nuclei														**
$*^{34}$Al^m	E : from FGK204 using a least-squares fit to data in 17Li03														**
$*^{34}$Al^m	J : 18Xu05=1														**
$*^{34}$Cl	T : average 06Ia05=1.5268(5) 83Ko22=1.5277(22) 76Wi08=1.5252(11)														**
$*^{34}$Cl	T : 73Ry01=1.526(2) 72Ha82=1.534(3)														**
$*^{34}$Ar	T : others 06Ia05=843.8(0.4) 74Ha26=844.5(3.4)														**
^{35}Na	37830#	670#				1.5	ms	0.5	$3/2^+$#	11			1983	β^-=100;β^-n ?;β^-2n ?	*
^{35}Mg	15640	270				11.3	ms	0.6	$(3/2^-,5/2^-)$	17	17Mo26	J	1989	β^-=100;β^-n=52 46;β^-2n ?	
^{35}Al	−224	7				38.16	ms	0.21	$(5/2^+,3/2^+)$	11	17Ch36	J	1979	β^-=100;β^-n=35.8 17; β^-2n ?	*
^{35}Si	−14390	40				780	ms	120	$7/2^-$#	15	95Re.A	D	1971	β^-=100;β^-n<5	
^{35}P	−24857.8	1.9				47.3	s	0.8	$1/2^+$	11			1971	β^-=100	
^{35}S	−28846.21	0.04				87.37	d	0.04	$3/2^+*$	11			1936	β^-=100	
^{35}S^i	−19691	10	9155	10	RQ			T=5/2	$(1/2:9/2)^+$	11			1975		
^{35}Cl	−29013.53	0.04				STABLE			$3/2^+*$	11			1919	IS=75.8 2	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$^{35}\mathrm{Cl}^{i}$	−23359.05	0.22	5654.48	0.22					$3/2^+$ T=3/2	11				IT=100	
$^{35}\mathrm{Ar}$	−23047.3	0.7				1.7756	s	0.0010	$3/2^+$	11			1940	β^+=100	
$^{35}\mathrm{Ar}^{i}$	−17474.6	0.7	5572.66	0.15					$3/2^+$ T=3/2	11				IT=100	
$^{35}\mathrm{K}$	−11172.9	0.5				175.2	ms	1.9	$3/2^+$	11	06Me04	J	1976	β^+=100;β^+p=0.37 15	*
$^{35}\mathrm{K}^{i}$	−2110	40	9060	40	2p				$3/2^+$ T=5/2						
$^{35}\mathrm{Ca}$	5190#	200#				25.7	ms	0.2	$1/2^+$#	11	99Tr04	DT	1985	β^+=100;β^+p=95.8 14; β^+2p=4.2 3	
$^{35}\mathrm{Sc}$	27100#	400#							$7/2^-$#					p ?	
*$^{35}\mathrm{Na}$	D : β^-n was observed by 83La12, but it was not quantified														**
*$^{35}\mathrm{Al}$	T : average 17Ha23=38.4(0.3) 05Ti11=36.8(0.5) 01Nu01=38.6(0.4); others														**
*$^{35}\mathrm{Al}$	T : 95Re.A=30(4) 89Le16=170(+90-50) 88Mu08=130(+100-50)														**
*$^{35}\mathrm{Al}$	D : %β^-n average 05Ti11=38(2) 01Nu01=41(13) 95Re.A=26(4) 89Le16=40(10);														**
*$^{35}\mathrm{Al}$	D : other 88Mu08=87(+37-25)														**
*$^{35}\mathrm{K}$	T : average 18Sa.A=175(2) 98Sc19=178(8)														**
$^{36}\mathrm{Na}$	45900#	690#				<180ns				12	02Le.A	I		n ?	
$^{36}\mathrm{Mg}$	20380	690				3.9	ms	1.3	0^+	12			1989	β^-=100;β^-n=48 12;β^-2n ?	*
$^{36}\mathrm{Al}$	5950	150				90	ms	40		12			1979	β^-=100;β^-n<31;β^-2n ?	
$^{36}\mathrm{Si}$	−12440	70				503	ms	2	0^+	12	95Re.A	D	1971	β^-=100;β^-n=12 5	*
$^{36}\mathrm{P}$	−20251	13				5.6	s	0.3	4^-	12	15Ch56	J	1971	β^-=100;β^-n ?	
$^{36}\mathrm{S}$	−30664.14	0.19				STABLE			0^+	12			1938	IS=0.0158 17	
$^{36}\mathrm{Cl}$	−29522.01	0.04				301.3	ky	1.5	2^+*	12			1941	β^-=98.1 1;β^+=1.9 1	
$^{36}\mathrm{Cl}^{i}$	−25222.34	0.04	4299.667	0.014					$(0)^+$ T=2	12				IT=100	
$^{36}\mathrm{Ar}$	−30231.542	0.027				STABLE			0^+	12			1920	IS=0.3336 210;2β^+ ?	
$^{36}\mathrm{Ar}^{i}$	−23620.5	0.3	6611.0	0.3					2^+ T=1	12				IT=100	
$^{36}\mathrm{Ar}^{j}$	−19379.4	1.2	10852.2	1.2	RQ				0^+ T=2	12				IT=100	
$^{36}\mathrm{K}$	−17417.2	0.3				341	ms	3	2^+*	12			1967	β^+=100;β^+p=0.048 14; $\beta^+\alpha$=0.0034 13	
$^{36}\mathrm{K}^{i}$	−13134.5	2.4	4282.7	2.4	p				0^+ T=2	12				p=100	*
$^{36}\mathrm{Ca}$	−6450	40				100.9	ms	1.3	0^+	12	15Su01	T	1977	β^+=100;β^+p=51.2 10	*
$^{36}\mathrm{Sc}$	16150#	300#												p ?	
*$^{36}\mathrm{Mg}$	D : %β^-n from 99YoZW														**
*$^{36}\mathrm{Si}$	T : from 17Ha23														**
*$^{36}\mathrm{K}^{i}$	E : Ensdf2012 reports 4281.9(0.8) as IAS of ^{36}Ca gs, but the small														**
*$^{36}\mathrm{K}^{i}$	E : uncertainty is not justified														**
*$^{36}\mathrm{Ca}$	T : average 15Su01=100.0(2.4) 07Do17=100.1(2.3) 95Tr02,97Tr05=102(2)														**
$^{37}\mathrm{Na}$	53130#	690#				1#	ms	>1.5us	$3/2^+$#	12	02Le.A	I	2002	β^- ?;β^-n ?;β^-2n ?	
$^{37}\mathrm{Mg}$	28210	700				8	ms	4	$(3/2^-)$	12	14Ko14	J	1996	β^- ?;β^-n ?;β^-2n ?	
$^{37}\mathrm{Al}$	9810	180				11.4	ms	0.3	$5/2^+$#	12	19Ab06	TD	1979	β^-=100;β^-n=52 5;β^-2n>1	*
$^{37}\mathrm{Si}$	−6570	110				141.0	ms	3.5	$(5/2^-)$	15	19Ab06	TJ	1979	β^-=100;β^-n=17 13;β^-2n ?	*
$^{37}\mathrm{P}$	−19000	40				2.31	s	0.13	$(1/2^+)$	12	15Ch56	J	1971	β^-=100;β^-n ?	
$^{37}\mathrm{S}$	−26896.43	0.20				5.05	m	0.02	$7/2^-$	12			1945	β^-=100	
$^{37}\mathrm{Cl}$	−31761.55	0.05				STABLE			$3/2^+$*	12			1919	IS=24.2 2	
$^{37}\mathrm{Cl}^{i}$	−21539.7	0.3	10221.8	0.3	RQ				$7/2^-$ T=5/2	12			1984	IT=100	
$^{37}\mathrm{Ar}$	−30947.68	0.21				35.011	d	0.019	$3/2^+$*	12			1941	ε=100	
$^{37}\mathrm{Ar}^{i}$	−25956	6	4992	6	RQ				$3/2^+$ T=3/2	12			1973		
$^{37}\mathrm{K}$	−24800.20	0.09				1.23651	s	0.00094	$3/2^+$*	12	14Sh25	T	1958	β^+=100	*
$^{37}\mathrm{K}^{i}$	−19749.9	0.8	5050.3	0.8	RQ				$3/2^+$ T=3/2	12			1973	IT=100	
$^{37}\mathrm{Ca}$	−13136.1	0.6				181.0	ms	0.9	$3/2^+$*	12	19Kl06	J	1964	β^+=100;β^+p=76.8 7	*
$^{37}\mathrm{Sc}$	3780#	300#							$7/2^-$#					p ?	
$^{37}\mathrm{Ti}$	25170#	400#							$1/2^+$#					p ?	
*$^{37}\mathrm{Al}$	T : average 19Ab06=11.3(0.4) 15St14=11.5(0.4)														**
*$^{37}\mathrm{Al}$	D : %β^-2n 15St14>1%														**
*$^{37}\mathrm{Si}$	T : average 19Ab06=138(4) 17Ha23=150(7)														**
*$^{37}\mathrm{K}$	J : also 14Kr04=3/2														**
*$^{37}\mathrm{Ca}$	T : average 15Su01=180.5(2.1) 07Do17=181.7(3.6) 97Tr05=181.1(1.0)														**
*$^{37}\mathrm{Ca}$	D : %β^+p average 15Su01=70.6(1.8) 07Do17=72.2(4.3) 97Tr05=78.4(0.8)														**
*$^{37}\mathrm{Ca}$	D : 74Se11=75(2). Ensdf2012 gives 97Tr05=82.1(0.7), which														**
*$^{37}\mathrm{Ca}$	D : differs from 97Tr05=78.4(0.8) quoted in the present evaluation														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{38}Na	61910#	720#						<400 ns			19Ah07	I		n ?	*
^{38}Mg	34070#	500#				2#	ms	>260ns	0^+	17			1997	β^-=100#;β^-n ?;β^-2n ?	
^{38}Al	16470#	150#				9.0	ms	0.7	0^-#	17	15St14	T	1989	β^-=100;β^-n=84 19;β^-2n ?	*
^{38}Si	−4170	100				63	ms	8	0^+	17	17Tr02	TD	1979	β^-=100#;β^-n=25 10	
^{38}P	−14620	70				640	ms	140	(2^-)	17	15Ch56	J	1971	β^-=100;β^-n=12 5	
^{38}S	−26861	7				170.3	m	0.7	0^+	17			1958	β^-=100	
^{38}Cl	−29798.12	0.10				37.230	m	0.014	2^-	17			1940	β^-=100	
^{38}Cl^m	−29126.75	0.10	671.365	0.008		715	ms	3	5^-	17			1954	IT=100	
^{38}Cl^i	−21590	24	8208	24	RQ				0^+ T=3	17					
^{38}Ar	−34714.83	0.19				STABLE			0^+	17			1934	IS=0.0629 70	
^{38}Ar^i	−24083.9	0.9	10630.9	0.9					(2^-) T=2	17					
^{38}Ar^j	−15940	30	18780	30	RQ				0^+ T=3	17					
^{38}K	−28800.76	0.20				7.651	m	0.019	3^+* T=0	17			1937	β^+=100	*
^{38}K^m	−28670.61	0.20	130.15	0.04	MD	924.35	ms	0.12	0^+* T=1	17	14Pa45	J	1953	β^+=99.9670 43; IT=0.0330 43	*
^{38}K^n	−25342.66	0.26	3458.10	0.17		21.95	μs	0.11	$(7)^+$	17			1971	IT=100	
^{38}Ca	−22058.50	0.19				443.70	ms	0.25	0^+	17	15Bl02	T	1966	β^+=100	*
^{38}Sc	−4250#	200#						<300ns	2^-#	17	94Bl10	I		p ?	
^{38}Sc^m	−3580#	220#	670#	100#					5^-#		Mirror	I		IT ?;p ?	
^{38}Ti	11370#	300#						<120ns	0^+	17	96Bl21	I		2p ?	
*^{38}Na	I : no events observed in 19Ah07														**
*^{38}Al	T : other 04Gr20=7.6(0.6) without β-γ coin gating														**
*^{38}K	J : 19Ko19,14Kr04,14Pa45=3														**
*^{38}K^m	T : average 10Ba43=924.46(0.14) 00Bb01=924.4(0.6) 83Ko22=924.15(0.31)														**
*^{38}K^m	T : 78Th02=928.8(2.0) 78Wi04=921.71(0.65) 76Wi08=922.3(1.1)														**
*^{38}K^m	T : 72Ha82=929.2(3.5) 75Sq01=925.6(0.7)														**
*^{38}Ca	T : average of 15Bl02=443.63(0.35) 11Pa38=443.77(0.36) 10Bl09=443.8(1.9)														**
^{39}Na	69980#	740#				1#	ms	>400ns	$3/2^+$#		19Ah07	I	2019	β^- ?;β^-n ?;β^-2n ?	*
^{39}Mg	42780#	510#						<180ns	$7/2^-$#	18				n ?;β^- ?	*
^{39}Al	21490#	300#				7.6	ms	1.6	$5/2^+$#	18			1989	β^-=100;β^-n=97 22;β^-2n ?	
^{39}Si	2320	140				41.2	ms	4.1	$(5/2^-)$	18	19Ab06	TDJ	1979	β^-=100;β^-n=33 3;β^-2n ?	*
^{39}P	−12770	110				282	ms	24	$(1/2^+)$	18	19Ab06	J	1977	β^-=100;β^-n=26 8	*
^{39}S	−23160	50				11.5	s	0.5	$(7/2)^-$	18			1971	β^-=100	
^{39}Cl	−29800.2	1.7				56.2	m	0.6	$3/2^+$	18			1949	β^-=100	
^{39}Ar	−33242	5				268	y	8	$7/2^-$*	18			1950	β^-=100	
^{39}Ar^i	−24161	7	9081	9	RQ				$3/2^+$ T=5/2	18	MMC149	J			*
^{39}K	−33807.195	0.005				STABLE			$3/2^+$*	18			1921	IS=93.2581 44	*
^{39}K^i	−27260.8	1.9	6546.4	1.9					$7/2^-$ T=3/2	18				IT=100	
^{39}Ca	−27282.7	0.6				860.3	ms	0.8	$3/2^+$*	18	19Kl06	J	1943	β^+=100	*
^{39}Ca^i	−20917#	9#	6366#	9#					$3/2^+$ T=3/2		Imme	E			
^{39}Sc	−14173	24							$7/2^-$#	18	94Bl10	I	1988	p=100	*
^{39}Sc^i	−5050	40	9120	50	2p				$(3/2^+)$ T=5/2	18					
^{39}Ti	2500#	200#				28.5	ms	0.9	$3/2^+$#	18	07Do17	TD	1990	β^+=100;β^+p=93.7 28; β^+2p=?	*
^{39}V	22570#	400#							$7/2^-$#					p ?	
*^{39}Na	I : one event observed in 19Ah07														**
*^{39}Mg	T : estimated partial β^- half-life of 1# ms														**
*^{39}Si	T : average 19Ab06=38.6(1.3) 04Gr20=47.5(2.0); Birge ratio=3.7														**
*^{39}P	T : average 04Gr20=250(80) 98Wi.A=320(30) 95Re.A=190(50)														**
*^{39}Ar^i	J : from IAS appartenance; 3/2+,5/2+ in Ensdf2018														**
*^{39}K	J : 19Ko19,14Kr04,14Pa45,13Pa11=3/2														**
*^{39}Ca	T : average 10Bl09=860.7(1.0) 77Az01=859.4(1.6) 73Al11=860.4(3.0)														**
*^{39}Sc	D : most likely a proton emitter from Sp=-597(24) keV														**
*^{39}Ti	D : %β^+p includes contribution from ^{39}Sc gs (%p=100); β^+2p decay was														**
*^{39}Ti	D : observed in 92Mo15, but was not quantified														**
^{40}Mg	49550#	500#				1#	ms	>170ns	0^+	17	14Cr02	I	2007	β^- ?;β^-n ?;β^-2n ?	*
^{40}Al	28820#	300#				10#	ms	>260ns		17			1996	β^- ?;β^-n ?;β^-2n ?	
^{40}Si	5670	120				31.2	ms	2.6	0^+	17	17Tr02	TD	1989	β^-=100;β^-n=38 5;β^-2n ?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{40}P	−8140	80				150	ms	8	$(2^-,3^-)$	17			1979	β^-=100;β^-n=15.8 21; β^-2n ?	
^{40}S	−22838	4				8.8	s	2.2	0^+	17			1971	β^-=100	
^{40}Cl	−27560	30				1.35	m	0.03	2^-	17			1956	β^-=100	
^{40}Ar	−35039.9000	0.0022				STABLE			0^+	17			1920	IS=99.6035 250	
^{40}K	−33535.50	0.06				1.248	Gy	0.003	4^-*	17			1935	IS=0.0117 1;β^-=89.28 13; β^+=10.72 13	*
^{40}K^m	−31891.86	0.06	1643.638	0.011		336	ns	12	0^+	17			1968	IT=100	
^{40}K^i	−29151.5	0.3	4384.0	0.3					0^+ T=2	17				IT=100	
^{40}Ca	−34846.402	0.020				STABLE		>9.9Zy	0^+	17	16An14	T	1922	IS=96.941 156;2β^+ ?	
^{40}Ca^i	−27188.22	0.05	7658.18	0.05					4^- T=1	17	AHW	E		IT=100	*
^{40}Ca^j	−22858.4	1.0	11988	1					0^+ T=2	17				IT=100	
^{40}Sc	−20523.4	2.8				182.3	ms	0.7	4^-	17			1955	β^+=100;β^+p=0.44 7; $\beta^+\alpha$=0.017 5	
^{40}Sc^i	−16164	6	4359	6	RQ				0^+ T=2	17				IT=100	
^{40}Ti	−8990	70				52.4	ms	0.3	0^+	17	07Do17	TD	1982	β^+=100;β^+p=95.8 13	
^{40}V	12470#	300#							2^-#					p ?	
*^{40}Mg	I : 5 events observed in direct two-proton removal from ^{42}Si														**
*^{40}Si	T : average 17Tr02=27.6(1.4) 04Gr20=33(1); Birge ratio=3.14														**
*^{40}K	J : also 14Kr04j=4														**
*^{40}Ca^i	E : originally 7658.23(0.05), recalibrated -0.05 keV for ^{27}Al+p														**
*^{40}Ca^i	E : resonances														**
^{41}Mg	58100#	500#							$3/2^-$#					β^- ?;β^-n ?	
^{41}Al	34590#	400#				6#	ms	>260ns	$5/2^+$#	16	97Sa14	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{41}Si	13200#	300#				20.0	ms	2.5	$7/2^-$#	16			1989	β^-=100;β^-n>55;β^-2n ?	*
^{41}P	−4980	120				101	ms	5	$1/2^+$#	16			1979	β^-=100;β^-n=30 10;β^-2n ?	
^{41}S	−19009	4				1.99	s	0.05	$7/2^-$#	16			1979	β^-=100;β^-n ?	
^{41}Cl	−27310	70				38.4	s	0.8	$(1/2^+)$	16			1971	β^-=100	
^{41}Ar	−33067.5	0.3				109.61	m	0.04	$7/2^-$	16			1936	β^-=100	
^{41}K	−35559.549	0.004				STABLE			$3/2^+$*	16			1921	IS=6.7302 44	*
^{41}K^i	−27210	15	8349	15	RQ				$7/2^-$ T=5/2	16	75Me10	J	1975		*
^{41}Ca	−35137.91	0.14				99.4	ky	1.5	$7/2^-$*	16			1939	ε=100	
^{41}Ca^i	−29320.8	0.5	5817.1	0.5		< 28	fs		$3/2^+$ T=3/2	16				IT=100	
^{41}Sc	−28642.36	0.08				596.3	ms	1.7	$7/2^-$	16			1941	β^+=100	
^{41}Sc^r	−25760.01	0.08	2882.35	0.05	RQ				$7/2^+$	16				p=59 2;IT=41 2	
^{41}Sc^i	−22704	3	5939	3	RQ				$3/2^+$ T=3/2	16				p=100	
^{41}Ti	−15698	28				81.9	ms	0.5	$3/2^+$	16	07Do17	D	1964	β^+=100;β^+p=91.1 6	
^{41}V	310#	200#							$7/2^-$#					p ?	
^{41}Cr	20410#	400#							$3/2^+$#					p ?	
*^{41}Si	D : %β^-n from Pn=103(38) in 99YoZW														**
*^{41}K	J : also 14Kr04j=3/2														**
*^{41}K^i	J : l=3 in (^{3}He,d); assigned as IAS of ^{41}Ar gs														**
^{42}Al	41990#	500#				3#	ms	>170ns		16			2007	β^- ?;β^-n ?;β^-2n ?	
^{42}Si	16840#	300#				12.5	ms	3.5	0^+	16			1990	β^-=100;β^-n ?;β^-2n ?	
^{42}P	1090	100				48.5	ms	1.5		16			1979	β^-=100;β^-n=50 20;β^-2n ?	
^{42}S	−17637.7	2.8				1.016	s	0.015	0^+	16	06Wi10	D	1979	β^-=100;β^-n<1	
^{42}Cl	−24830	60				6.8	s	0.3	(2^-)	16			1971	β^-=100;β^-n ?	
^{42}Ar	−34423	6				32.9	y	1.1	0^+	16			1952	β^-=100	
^{42}K	−35022.03	0.11				12.355	h	0.007	2^-*	16			1935	β^-=100	*
^{42}K^i	−28570	100	6450	100					(0^+) T=3	16					
^{42}Ca	−38547.29	0.15				STABLE			0^+	16			1934	IS=0.647 23	
^{42}Ca^i	−28797	10	9750	10					(2^-) T=2	16					
^{42}Sc	−32121.00	0.15				680.72	ms	0.26	0^+ T=1	16	97Ko65	T	1955	β^+=100	*
^{42}Sc^m	−31504.19	0.16	616.81	0.06	MD	61.7	s	0.4	7^+	16			1963	β^+=100	
^{42}Sc^r	−26044.80	0.16	6076.20	0.07	RQ				$(2^+,3^+,4^+)$	16				IT=100	
^{42}Ti	−25104.35	0.27				208.3	ms	0.4	0^+	16	15Mo01	T	1964	β^+=100	*
^{42}V	−7620#	200#						<55ns	2^-#	16	92Bo37	I		p ?	
^{42}Cr	7060#	300#				13.3	ms	1.0	0^+	16			1996	$\beta^+\approx$100;β^+p=94.4 50;2p ?	
*^{42}K	J : 19Ko19,14Kr04,14Pa45=2														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{42}Sc	T : average 97Ko65=680.67(0.28) 76Wi08=680.98(0.62)												**
*^{42}Ti	T : average 15Mo01=211.7(1.9), 209.5(5.2) 09Ku19=208.14(0.45)												**
^{43}Al	48270#	600#				4# ms >170ns	$5/2^+$#	15			2007	β^- ?;β^-n ?;β^-2n ?	
^{43}Si	24330#	400#				30# ms >260ns	$3/2^-$#	15	02No11	I	2002	β^- ?;β^-n ?;β^-2n ?	
^{43}P	5040#	300#				35.8 ms 1.3	$(1/2^+)$	15	04Gr20	T	1989	β^-=100;β^-n=100;β^-2n ?	*
^{43}S	−12195	5				265 ms 13	$3/2^-$	15	20Mo32	J	1979	β^-=100;β^-n=40 10	
^{43}S^m	−11874	5	320.7	0.5		415.0 ns 2.6	$(7/2^-)$	15	09Ga05	J	2000	IT=100	*
^{43}Cl	−24160	60				3.13 s 0.09	$(3/2^+)$	15	06Wi10	JT	1976	β^-=100;β^-n ?	*
^{43}Ar	−32010	5				5.37 m 0.06	$5/2(^-)$	15			1969	β^-=100	
^{43}K	−36575.4	0.4				22.3 h 0.1	$3/2^+$*	15	14Kr04	J	1949	β^-=100	
^{43}K^m	−35837.1	0.4	738.30	0.06		200 ns 5	$7/2^-$	15			1978	IT=100	
^{43}Ca	−38408.87	0.23				STABLE	$7/2^-$*	15			1934	IS=0.135 10	*
^{43}Ca^i	−30414	14	7995	14	RQ		$(3/2)^+$ T=5/2	15					
^{43}Sc	−36188.1	1.9				3.891 h 0.012	$7/2^-$*	15			1935	β^+=100	*
^{43}Sc^m	−36036.3	1.9	151.79	0.08		438 μs 5	$3/2^+$	15	77Mi10	T	1964	IT=100	*
^{43}Sc^n	−33064.4	1.9	3123.73	0.15		472 ns 3	$19/2^-$	15	08Fe02	T	1978	IT=100	*
^{43}Sc^i	−31956	3	4232	4	RQ		$7/2^-$ T=3/2	15					
^{43}Ti	−29316	6				509 ms 5	$7/2^-$	15			1948	β^+=100;β^+p ?	
^{43}Ti^m	−29003	6	313.0	1.0		11.9 μs 0.3	$(3/2^+)$	15			1978	IT=100	
^{43}Ti^n	−26250	6	3066.4	1.0		556 ns 6	$(19/2^-)$	15			1978	IT=100	
^{43}Ti^i	−24610#	50#	4710#	50#			$7/2^-$# T=3/2						
^{43}V	−17920	40				79.3 ms 2.4	$7/2^-$#	15	07Do17	D	1987	β^+=100;β^+p<2.5	
^{43}V^i	−9705	15	8210	50	RQ		$3/2^+$ T=5/2						
^{43}Cr	−1970#	200#				21.1 ms 0.3	$(3/2^+)$	15	11Po01	T	1992	β^+=100;β^+p=79.3 30; β^+2p=11.6 10; β^+3p=0.13 +18-8;$\beta^+\alpha$?	*
^{43}Mn	17370#	400#					$5/2^-$#					p ?	
*^{43}P	T : average 04Gr20=36.5(1.5) 95So03=33(3)												**
*^{43}S^m	T : average 12Ch16=415(3) 09Ga05=415(5)												**
*^{43}Cl	T: 06Wi10, supersedes 98WiZX=3.07(0.07); others 81Vo04=3.3(0.2)												**
*^{43}Cl	T: 81HuZT=3.4(0.3)												**
*^{43}Ca	J : also 15Ru02=7/2												**
*^{43}Sc	J : also 11Av01=7/2												**
*^{43}Sc^m	T : average 77Mi10=438(7) 65De15=470(20) 64Ho14=435(7)												**
*^{43}Sc^n	T : average 08Fe02=481(9) 81Da06=469(4) 78Ha07=473(5)												**
*^{43}Cr	T : average 11Po01=20.6(0.9) 07Do17=21.1(0.4) 01Gi01=21.6(0.7)												**
^{44}Si	29310#	500#				4# ms >360ns	0^+	11			2007	β^- ?;β^-n ?;β^-2n ?	
^{44}P	11110#	400#				18.5 ms 2.5		11			1989	β^-=100;β^-n ?;β^-2n ?	
^{44}S	−9204	5				100 ms 1	0^+	11			1979	β^-=100;β^-n=18 3	
^{44}S^m	−7839	5	1365.0	0.8		2.619 μs 0.026	0^+	11			2005	IT=100	
^{44}Cl	−20480	90				562 ms 106	(2^-)	11			1979	β^-=100;β^-n<8	*
^{44}Ar	−32673.3	1.6				11.87 m 0.05	0^+	11			1969	β^-=100	
^{44}K	−35781.5	0.4				22.13 m 0.19	2^-*	11			1954	β^-=100	*
^{44}Ca	−41468.7	0.3				STABLE	0^+	11			1922	IS=2.086 110	
^{44}Ca^i	−29619	10	11850	10			2^- T=3	11	MMC143J				*
^{44}Sc	−37816.0	1.8				4.0421 h 0.0025	2^+*	11	16Ga24	T	1937	β^+=100	*
^{44}Sc^m	−37748.1	1.8	67.8679	0.0014		154.8 ns 0.8	1^-	11			1967	IT=100	
^{44}Sc^n	−37669.8	1.8	146.1914	0.0020		51.0 μs 0.3	0^-	11			1963	IT=100	
^{44}Sc^p	−37544.8	1.8	271.240	0.010		58.61 h 0.10	6^+*	11			1940	IT=98.80 7;β^+=1.20 7	*
^{44}Sc^i	−35038.3	2.5	2778	3	RQ		0^+ T=2	11					
^{44}Ti	−37548.6	0.7				59.1 y 0.3	0^+	11			1954	ε=100	
^{44}Ti^i	−30942.2	0.9	6606.4	0.5			2^+ T=1	11				IT=100	
^{44}Ti^j	−28210.6	2.1	9338	2			0^+ frg. T=2	11				IT=100	
^{44}V	−23808	7				111 ms 7	$(2)^+$	11			1971	β^+=100;$\beta^+\alpha$=?;β^+p ?	
^{44}V^m	−23537	5	271	9	MD	150 ms 3	$(6)^+$	11			1997	β^+=100	
^{44}V^n	−23660#	100#	150#	100#			0^-#		Mirror	I			
^{44}V^i	−21119	12	2689	14	p		0^+# T=2		92Bo37	D	1992	p=100	
^{44}Cr	−13420	50				42.8 ms 0.6	0^+	11	07Do17	TD	1987	β^+=100;β^+p=12 2	*
^{44}Mn	7460#	300#				<105ns	2^-#	11				p ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

$*^{44}$Cl T : average 99WiZX=650(50) 95So03=434(60); Birge ratio=2.77 **
$*^{44}$K J : 19Ko19,14Kr04,14Pa45=2 **
$*^{44}$Ca^{i} J : from (e,e') in 84Ra04; IAS candidate **
$*^{44}$Sc T : average 16Ga24=4.0420(0.0025) 69Sa34=4.05(0.03). others (not used) **
$*^{44}$Sc T : 69Ra16=3.927(0.008) 66Ta01=4.00(0.02) **
$*^{44}$Sc J : also 11Av01=2 **
$*^{44}$Sc^{p} J : also 11Av01=6 **
$*^{44}$Cr T : others 14Po05=25(+6-4) 92Bo37=53(+4-3) **
$*^{44}$Cr D : %β^+p average 07Do17=14.0(0.9) 14Po05=10(1); Birge ratio=2.97; **
$*^{44}$Cr D : other 96Fa09>7(3) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life		J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{45}Si	37090#	600#					4# ms		$3/2^-$#					β^- ?;β^-n ?;β^-2n ?	
^{45}P	15960#	500#					10# ms	>200ns	$1/2^+$#	08			1990	β^- ?;β^-n ?;β^-2n ?	
^{45}S	−3340#	300#					68 ms	2	$3/2^-$#	08			1989	β^-=100;β^-n≈54;β^-2n ?	
^{45}Cl	−18260	140					413 ms	25	$(3/2^+)$	08	12Ri08	J	1979	β^-=100;β^-n=24 4	
^{45}Ar	−29770.8	0.5					21.48 s	0.15	$(5/2^-,7/2^-)$	08			1974	β^-=100	
^{45}K	−36615.6	0.5					17.8 m	0.6	$3/2^+*$	08	14Kr04	J	1964	β^-=100	
^{45}Ca	−40812.2	0.4					162.61 d	0.09	$7/2^-*$	08			1940	β^-=100	*
^{45}Sc	−41072.3	0.7					STABLE		$7/2^-*$	08			1923	IS=100	*
^{45}Sc^{m}	−41059.9	0.7	12.40	0.05			318 ms	7	$3/2^+$	08			1964	IT=100	
^{45}Sc^{i}	−34373	15	6699	15					$7/2^-$ T=5/2	08					
^{45}Ti	−39010.3	0.8					184.8 m	0.5	$7/2^-*$	08			1941	β^+=100	
^{45}Ti^{m}	−38973.8	0.8	36.53	0.15			3.0 μs	0.2	$3/2^-$	08			2006	IT=100	
^{45}Ti^{i}	−34291	3	4719	3	RQ				$7/2^-$ T=3/2	08					
^{45}V	−31886.4	0.9					547 ms	6	$7/2^-$	08			1975	β^+=100	
^{45}V^{m}	−31829.6	1.1	56.8	0.6			512 ns	13	$(3/2^-)$	08	11Ho02	T	1980	IT=100	*
^{45}V^{i}	−27090	9	4797	9	RQ				$7/2^-$ T=3/2	08				p=100	
^{45}Cr	−19510	40				*	60.9 ms	0.4	$7/2^-$#	08			1974	β^+=100;β^+p=34.4 8	
^{45}Cr^{m}	−19400	40	107	1		*	> 80 μs		(3/2)	11	11Ho02	ETJ	2011	IT=100	
^{45}Mn	−4980#	300#						<70ns	$5/2^-$#	08	92Bo37	I		p ?	
^{45}Fe	14410#	280#					2.5 ms	0.2	$3/2^+$#	08	07Mi36	TD	1996	2p=70 4;β^+=30 4; β^+p=18.9 35;β^+2p=7.8 23	*

$*^{45}$Ca J : also 15Ru02=7/2 **
$*^{45}$Sc J : also 11Av01=7/2 **
$*^{45}$V^{m} T : average 11Ho02=468(23) 87Ha.B=430(80) 82Ho11=539(18) 82Al.C=610(80) **
$*^{45}$V^{m} T : 80Gr.A=510(50) **
$*^{45}$Fe T : average 07Mi40=2.6(0.2) (2p gated) 07Mi36=2.8(0.4) (β gated) **
$*^{45}$Fe T : 05Do20=1.6(+0.5-0.3) 02Gi09=4.7(+3.4-1.4) 02Pf02=3.2(+2.6-1.0); **
$*^{45}$Fe T : 02Gi09 supersedes 01Gi01=6(+17-3), 5.98(2.49), 4.22(1.88) **
$*^{45}$Fe D : %2p from 07Mi40; other 05Do20=57(10)%. **

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life		J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{46}P	22840#	500#					9# ms	>200ns		00	90Le03	I	1990	β^- ?;β^-n ?;β^-2n ?	
^{46}S	640#	400#					50 ms	8	0^+	10			1989	β^-=100;β^-n ?;β^-2n ?	
^{46}Cl	−13730	100					232 ms	2	2^-#	12			1989	β^-=100;β^-n=60 9;β^-2n ?	
^{46}Ar	−29771.3	2.3					8.4 s	0.6	0^+	00			1974	β^-=100	
^{46}K	−35413.9	0.7					96.30 s	0.08	2^-*	00	14Ku.A	T	1965	β^-=100	*
^{46}Ca	−43139.6	2.2					STABLE		0^+	00			1938	IS=0.004 3;2β^- ?	*
^{46}Sc	−41761.6	0.7					83.757 d	0.014	4^+*	00	FGK204	T	1936	β^-=100	*
^{46}Sc^{m}	−41709.6	0.7	52.011	0.001			9.4 μs	0.8	6^+	00			1966	IT=100	
^{46}Sc^{n}	−41619.1	0.7	142.528	0.007			18.75 s	0.04	1^-	00			1948	IT=100	
^{46}Sc^{i}	−36748	4	5014	4	RQ				0^+ T=3	00					
^{46}Ti	−44128.27	0.09					STABLE		0^+	00			1934	IS=8.25 3	
^{46}Ti^{i}	−34962	7	9166	7	RQ				4^+ T=2	00					
^{46}Ti^{j}	−29977	6	14151	6	RQ				0^+ T=3	00					
^{46}V	−37075.90	0.13					422.62 ms	0.05	0^+ T=1	00	12Pa07	T	1952	β^+=100	*
^{46}V^{m}	−36274.44	0.16	801.46	0.10			1.02 ms	0.07	3^+ T=0	00			1962	IT=100	
^{46}Cr	−29472	11					224.3 ms	1.3	0^+	10	15Mo01	T	1972	β^+=100	*
^{46}Cr^{i}	−20328	13	9143	17	RQ				(4^+) T=2	10				p=?	
^{46}Mn	−12420	90				*	36.2 ms	0.4	(4^+)	10			1987	β^+=100;β^+p=57.0 8; β^+2p≈18;$\beta^+\alpha$?	*
^{46}Mn^{m}	−12270#	140#	150#	100#		*	1# ms		1^-#					β^+ ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{46}Mn^i	−7390	50	5030	100	p				T=3						
^{46}Fe	1210#	300#				13.0	ms	2.0	0^+	10	07Do17	TD	1992	β^+=100;β^+p=78.7 38; β^+2p=?	*
*^{46}K	J : 19Ko19,14Kr04,14Pa45,82To02=2														**
*^{46}K	T : other 19Po06=96.5(4)														**
*^{46}Ca	T : 99Be64 : 0nu-BB>100 Ey														**
*^{46}Sc	J : other 11Av01=4														**
*^{46}V	T : average 12Pa07=422.66(0.06) 97Ko65=422.57(0.13) 77Ba01=422.28(0.23)														**
*^{46}V	T : 77Al11=422.47(0.39); others 74Ha59=423.4(2.0) 73Al02=425.3(2.0)														**
*^{46}Cr	T : others (outweighed) 15Mo01=223.9(9.9) 05On03=240(140) 72Zi02=260(60)														**
*^{46}Mn	T : others 92Bo37=41(+7-6) 01Gi01=34.0(+4.5-3.5)														**
*^{46}Mn	D : %β^+2p estimated from Pp = %β^+p + 2*%β^+2p = 57(1)														**
*^{46}Fe	T : average 14Po05=16.4(+4.2-2.8) 07Do17=13.0(2.0) 01Gi01=9.7(+3.5-4.3)														**
*^{46}Fe	D : other %β^+p 14Po05=66(4)% 01Gi01=36(20)%; β^+2p, 1 event in 14Po05														**
^{47}P	28810#	600#				4#	ms	>400ns	$1/2^+$#		18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{47}S	7200#	400#				24#	ms	>200ns	$3/2^-$#	07	89Gu03	I	1989	β^- ?;β^-n ?;β^-2n ?	
^{47}Cl	−9580#	200#				101	ms	5	$3/2^+$#	07			1989	β^-=100;β^-n<3;β^-2n ?	
^{47}Ar	−25367.3	1.2				1.23	s	0.03	$(3/2)^-$	07			1985	β^-=100;β^-n<0.2	
^{47}K	−35712.0	1.4				17.38	s	0.03	$1/2^+$*	07	20Sm02	T	1964	β^-=100	*
^{47}Ca	−42344.7	2.2				4.536	d	0.003	$7/2^-$*	07			1951	β^-=100	*
^{47}Sc	−44336.8	1.9				3.3492	d	0.0006	$7/2^-$*	07			1945	β^-=100	
^{47}Sc^m	−43570.0	1.9	766.83	0.09		272	ns	8	$(3/2)^+$	07			1968	IT=100	
^{47}Ti	−44937.61	0.08				STABLE			$5/2^-$*	07			1934	IS=7.44 2	
^{47}Ti^i	−37588.6	0.7	7349.0	0.7					$7/2^-$ T=5/2	07					
^{47}V	−42007.07	0.11				32.6	m	0.3	$3/2^-$*	07			1942	β^+=100	
^{47}V^i	−37856.72	0.16	4150.35	0.11					$5/2^{(-)}$ T=3/2	07				IT=100	
^{47}Cr	−34563	5				461.6	ms	1.5	$3/2^-$	07			1972	β^+=100	*
^{47}Cr^j	−29803#	21#	4760#	20#					$5/2^-$# T=5/2						
^{47}Mn	−22570	30				88.0	ms	1.3	$5/2^-$#	07	07Do17	TD	1987	β^+=100;β^+p<1.7	
^{47}Mn^i	−15191	17	7380	40	RQ				$7/2^-$# T=5/2	07			2001	p=100	
^{47}Fe	−7130#	500#				21.9	ms	0.2	$7/2^-$#	07	07Do17	TD	1992	β^+=100;β^+p=88.4 9	
^{47}Fe^m	−6360#	510#	770#	100#					$3/2^+$#		Mirror	I		IT ?	
^{47}Co	10620#	600#							$7/2^-$#	07	Mirror	I		p ?	
*^{47}K	J : 19Ko19,14Kr04,14Pa45,13Pa11=1/2														**
*^{47}Ca	J : also 15Ru02=7/2														**
*^{47}Cr	T: average 77Ed01=460.0(1.5) 77Ho25=452(18) 85Bu07=508(10)														**
*^{47}Cr	T: 88HaZB=472.0(6.3) 85HoZS=520(40) 17Ku12=460(80)														**
^{48}S	12390#	500#				10#	ms	>200ns	0^+	06			1990	β^- ?;β^-n ?;β^-2n ?	
^{48}Cl	−4280#	500#				30#	ms	>200ns		06	89Gu03	I	1989	β^- ?;β^-n ?;β^-2n ?	
^{48}Ar	−22355	17				415	ms	15	0^+	10	12We08	TD	2004	β^-=100;β^-n=38 6	*
^{48}K	−32284.5	0.8				6.83	s	0.14	1^-*	06			1972	β^-=100;β^-n=1.14 15	*
^{48}Ca	−44224.868	0.018				56	Ey	10	0^+	06	20Ba.A	T	1938	IS=0.187 21;2β^-=?;β^- ?	*
^{48}Sc	−44504	5				43.67	h	0.09	6^+*	06			1937	β^-=100	
^{48}Ti	−48492.95	0.07				STABLE			0^+	06			1923	IS=73.72 3	
^{48}Ti^i	−37767	6	10726	6					(6^+) T=3	06					
^{48}V	−44478.0	1.0				15.9735	d	0.0025	4^+*	06			1937	β^+=100	
^{48}V^i	−41459.16	0.23	3018.8	0.9	RQ				$(0)^+$ T=2	06				IT=100	
^{48}Cr	−42821	7				21.56	h	0.03	0^+	06			1952	β^+=100	
^{48}Cr^i	−37028	7	5792.77	0.24					4^+ T=1	06			1987	IT=100	
^{48}Cr^j	−34061	15	8760	17	RQ				0^+ frg. T=2	06					*
^{48}Mn	−29297	7				158.1	ms	2.2	4^+	06			1987	β^+=100;β^+p=0.28 4; $\beta^+\alpha$=6e-4	
^{48}Mn^i	−26260	7	3036.7	0.9	IT				0^+ T=2	06	MMC12	J		p=100	
^{48}Fe	−18010	90				45.3	ms	0.6	0^+	06	07Do17	TD	1987	β^+=100;β^+p=15.3 5	
^{48}Co	1730#	500#							6^+#	06				p ?	
^{48}Ni	18180#	420#				2.8	ms	0.8	0^+	06	11Po09	TD	2000	2p=70 20;β^+=30 20;β^+p ?	*
*^{48}Ar	T : average 12We08=381(35) 412(19) 04Gr20=475(40)														**
*^{48}K	J : 14Kr04,14Pa45=1														**
*^{48}K	T : average 75Mu08=6.8(0.2) 81HuZT=6.9(0.2) 78De17=6(1)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{48}Ca	T : $2\beta^-$ symmetrized from 20Ba.A=53(+12-8); other 15Ba11=44(+6-5)														**
*^{48}Cr^j	E : strongly fragmented state; other: 10(15) keV lower														**
*^{48}Fe	D : %β^+p average 07Do17=15.9(6) 16Or03=14.4(7); other 96Fa09>3.6(1.1)														**
*^{48}Fe	T : other 16Or03=51(3) 96Fa09=44(7)														**
*^{48}Ni	T : average 05Do20=2.1(+2.1-0.7) 14Po05=11Po09=2.1(+1.4-0.4)														**
^{49}S	20390#	580#				4#	ms	>400ns	$1/2^-$#	08	18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{49}Cl	740#	400#				35#	ms	>200ns	$3/2^+$#	08	89Gu03	I	1989	β^- ?;β^-n ?;β^-2n ?	
^{49}Ar	−17060#	400#				236	ms	8	$3/2^-$#	08	12We08	TD	1989	β^-=100;β^-n=29 6;β^-2n ?	
^{49}K	−29611.5	0.8				1.26	s	0.05	$1/2^+$*	11			1972	β^-=100;β^-n=86 9	*
^{49}Ca	−41300.00	0.18				8.718	m	0.006	$3/2^-$*	08			1950	β^-=100	*
^{49}Sc	−46562.4	2.3				57.18	m	0.13	$7/2^-$	08			1940	β^-=100	
^{49}Ti	−48564.01	0.08				STABLE			$7/2^-$*	08			1934	IS=5.41 2	
^{49}V	−47962.2	0.8				330	d	15	$7/2^-$*	08			1940	ε=100	
^{49}V^i	−41531	4	6432	4	RQ				$7/2^-$ T=5/2						
^{49}Cr	−45332.4	2.2				42.3	m	0.1	$5/2^-$*	08			1942	β^+=100	*
^{49}Cr^i	−40568	5	4764	5					$(7/2)^-$ T=3/2	08	85Fu03	E	1969	IT=100	*
^{49}Mn	−37619.9	2.2				382	ms	7	$5/2^-$	08			1970	β^+=100	*
^{49}Mn^i	−32803	18	4817	18	p				$(7/2^-)$ T=3/2	08				p=100	
^{49}Fe	−24751	24				64.7	ms	0.3	$(7/2^-)$	08	96Fa09	J	1970	β^+=100;β^+p=56.7 4	
^{49}Co	−9780#	500#						<35ns	$7/2^-$#	08	94Bl10	I		p ?	
^{49}Ni	8530#	600#				7.5	ms	1.0	$7/2^-$#	08			1996	β^+=100;β^+p=83.4 13.2	
*^{49}K	J : 14Kr04,14Pa45,13Pa11=1/2														**
*^{49}Ca	J : 15Ru02,16Ga34=3/2														**
*^{49}Cr	T : other 18Tu03=44.0(2.7) for q=24+ (bare ion)														**
*^{49}Cr^i	E : strongest component surrounded by several weak l=3 lines.														**
*^{49}Cr^i	E : 85Fu03 cannot confirm IAS identity and fragmentation														**
*^{49}Mn	T: average 80Ha12=384(17) 87Ha.A=381.7(7.4) 17Ku12=380(30)														**
^{50}Cl	7700#	400#				10#	ms	>620ns		19	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{50}Ar	−13230#	500#				106	ms	6	0^+	19			1989	β^-=100;β^-n=37 7;β^-2n ?	
^{50}K	−25728	8				472	ms	4	0^-*	19			1972	β^-=100;β^-n=28.6 24; β^-2n ?	*
^{50}K^m	−25556	8	172.0	0.4		125	ns	40	(2^-)	19	10Da06	T	1999	IT=100	
^{50}Ca	−39589.2	1.6				13.45	s	0.05	0^+	19			1964	β^-=100	
^{50}Sc	−44537.1	2.5				102.5	s	0.5	5^+	19			1959	β^-=100	
^{50}Sc^m	−44280.2	2.5	256.895	0.010		350	ms	40	2^+	19			1963	IT>99;β^-<1	
^{50}Ti	−51431.87	0.08				STABLE			0^+	19			1934	IS=5.18 2	
^{50}V	−49223.24	0.09				271	Py	13	6^+*	19	20Da12	T	1949	IS=0.250 10;$\beta^+\approx$100;β^- ?	*
^{50}V^i	−44410.71	0.28	4812.53	0.27	RQ				0^+ T=3	10					
^{50}Cr	−50261.36	0.09				STABLE		>1.3Ey	0^+	19			1930	IS=4.345 13;2β^+ ?	*
^{50}Cr^i	−41836	7	8425	7	RQ				6^+ T=2	19					
^{50}Cr^j	−37039	6	13222	6	RQ				0^+ T=3	19					
^{50}Mn	−42626.89	0.12				283.21	ms	0.07	0^+* T=1	19	06Ba33	T	1952	β^+=100	*
^{50}Mn^m	−42401.57	0.11	225.31	0.07	MD	1.75	m	0.03	5^+* T=0	19			1962	β^+=100	
^{50}Fe	−34476	8				152.0	ms	0.6	0^+	19	15Mo01	T	1977	β^+=100;β^+p$\approx$0	*
^{50}Fe^i	−25999	10	8478	13	RQ				(6^+) T=2	19					
^{50}Co	−17590	130				38.8	ms	0.2	(6^+)	19			1987	β^+=100;β^+p=70.5 7;β^+2p ?	
^{50}Co^i	−12747	15	4840	130	2p				$(0)^+$ T=3	19				p=100	
^{50}Ni	−3460#	500#				18.5	ms	1.2	0^+	19	07Do17	TD	1994	β^+=100;β^+p=73 6; β^+2p=14 5	*
*^{50}K	J : 14Kr04,14Pa45=0														**
*^{50}K	D : %β^-n average 83La23=28(4) 82Ca04=29(3)														**
*^{50}V	T : β^+ average 20Da12=277(+20-19) 19La09=267(+16-18); β^- 20Da12>8900 Py														**
*^{50}Cr	T : 03Bi05>1.3Ey 85No03>0.18Ey														**
*^{50}Mn	T : average 06Ba33=283.10(0.14) 97Ko65=283.29(0.08) 76Wi08=282.72(0.26)														**
*^{50}Mn	T : 75Fr02=282.8(0.3) 74Ha59=284.0(0.4)														**
*^{50}Fe	T : average 15Mo01=152.1(0.6, beta), 150.1(2.9, gamma); others (outweighed)														**
*^{50}Fe	T : 17Ku12=145(13) 97Ko46=155(11)														**
*^{50}Ni	T : other 03Ma34=12(+3-2)														**
*^{50}Ni	D : %β^+p + %β^+2p 07Do17=86.7(3.9), other 03Ma34=70(20); %β^+2p 07Do17=14(5)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{51}Cl	14290#	700#				5# ms >200ns	$3/2^+$#	16			1990	β^- ?;β^-n ?;β^-2n ?	
^{51}Ar	−6490#	400#				30# ms >200ns	$1/2^-$#	16	89Gu03	I	1989	β^- ?;β^-n ?;β^-2n ?	
^{51}K	−22515	13				365 ms 5	$3/2^+$*	16			1983	β^-=100;β^-n=65 6;β^-2n ?	*
^{51}Ca	−36332.3	0.5				10.0 s 0.8	$3/2^-$*	16			1980	β^-=100;β^-n ?	*
^{51}Sc	−43250.4	2.5				12.4 s 0.1	$(7/2)^-$	16			1966	β^-=100;β^-n ?	
^{51}Ti	−49733.0	0.5				5.76 m 0.01	$3/2^-$	16			1947	β^-=100	
^{51}V	−52203.11	0.10				STABLE	$7/2^-$*	16	76Fu06	J	1924	IS=99.750 10	
^{51}Cr	−51450.71	0.17				27.7015 d 0.0011	$7/2^-$*	16	FGK204	T	1940	ε=100	
^{51}Cr^i	−44838	5	6613	5	RQ		$7/2^-$ T=5/2	16					
^{51}Mn	−48243.2	0.3				45.81 m 0.21	$5/2^-$*	16			1938	β^+=100	*
^{51}Mn^i	−43792.6	1.5	4450.6	1.5	RQ		$7/2^-$ T=3/2	16				IT=100	
^{51}Fe	−40189.2	1.4				305.4 ms 2.3	$5/2^-$	16	15Sh16	T	1972	β^+=100	*
^{51}Co	−27340	50				68.8 ms 1.9	$7/2^-$	16			1987	β^+=100;β^+p<3.8	
^{51}Co^i	−20674	18	6670	50	p		$7/2^-$# T=5/2		07Do17	D		p=100	
^{51}Ni	−11650#	500#				23.8 ms 0.2	$7/2^-$#	16	07Do17	TD	1987	β^+=100;β^+p=87.2 8; β^+2p=0.5 2	*

*^{51}K D : %β^-n average 06Pe16=63(8) 83La23=68(10); other 82Ca04=47(5) **
*^{51}K J : 14Pa45,14Kr04,06Pe16,13Pa11=3/2 **
*^{51}Ca J : 06Pe16,15Ru0,16Ga34=3/2 **
*^{51}Mn J : 15Ba49,65Sa22,68Jo18=5/2 **
*^{51}Mn T : average 17Gr12=45.59(0.07) 70Er01=46.2(0.1) 66Gl02=46.5(0.2); **
*^{51}Fe T : average 15Sh16=308(5) 13Su07=301(4) 87Ha.B=305(5) 84Ay01=310(5); **
*^{51}Fe T : other 17Ku12=288(6) is ∼7 sigma away from the average value **
*^{51}Ni D : %β^+2p from 12Au08 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{52}Cl	22360#	700#				2# ms >400ns			18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{52}Ar	−1380#	600#				40# ms >620ns	0^+	15	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{52}K	−17140	30				110 ms 4	2^-#	15	06Pe16	TD	1983	β^-=100;β^-n=72.2 9.3; β^-2n=2.3 3	*
^{52}Ca	−34266.3	0.7				4.6 s 0.3	0^+	15	83La23	D	1985	β^-=100;β^-n<2	
^{52}Sc	−40524	3				8.2 s 0.2	$3(^+)$	15			1980	β^-=100;β^-n ?	
^{52}Ti	−49477.7	2.7				1.7 m 0.1	0^+	15			1966	β^-=100	
^{52}V	−51443.03	0.16				3.743 m 0.005	3^+	15			1934	β^-=100	
^{52}Cr	−55419.51	0.11				STABLE	0^+	15			1923	IS=83.789 18	
^{52}Cr^i	−44154.6	0.4	11264.9	0.4			3^+ T=3	15				IT=100	
^{52}Mn	−50711.39	0.13				5.591 d 0.003	6^+*	15			1938	β^+=100	
^{52}Mn^m	−50333.64	0.13	377.749	0.005		21.1 m 0.2	2^+*	15			1937	β^+=98.22 5;IT=1.78 5	*
^{52}Mn^i	−47785	5	2926	5	RQ		0^+ T=2	15				IT=100	
^{52}Fe	−48332.10	0.18				8.275 h 0.008	0^+	15			1948	β^+=100	*
^{52}Fe^m	−41371.43	0.29	6960.7	0.3	MD	45.9 s 0.6	12^+	15			1979	β^+=99.979 5;IT=0.021 5	*
^{52}Fe^i	−42677.6	0.4	5654.5	0.4			6^+ T=1	15				IT=100	
^{52}Fe^j	−39776	6	8556	6	RQ		0^+ frg. T=2	15					*
^{52}Co	−34344	5				111.7 ms 2.1	6^+	15	16Or08	TJ	1987	β^+=100;β^+p ?	*
^{52}Co^m	−33968	8	376	9	MD	102 ms 5	2^+		16Or08	TJ	2016	β^+≈100;IT ?;β^+p ?	*
^{52}Co^i	−31420	8	2924	9	IT		0^+ T=2		16Or03	D	2016	IT=75 23;p=?	
^{52}Ni	−22560	80				41.8 ms 1.0	0^+	15	16Or03	TD	1987	β^+=100;β^+p=31.1 5	*
^{52}Cu	−1880#	600#					3^+#		Mirror	I		p ?	

*^{52}K T : average 06Pe16=118(6) 85Hu03=110(30) 83La23=105(5) **
*^{52}Mn^m T : other: 95Ir01=22.7(3.0) for q=25+ (bare ion) **
*^{52}Fe T : other: 95Ir01=12.5(+1.5-1.2) for q=26+ (bare ion) 67Pa22=8.23(0.04) **
*^{52}Fe^m E : other 6958.0(0.4) keV from a least-squares fit to Eg in Ensdf2015 **
*^{52}Fe^m D : %IT from 05Ga20; other 79Ga02<0.4 **
*^{52}Fe^j E : probably fragmented, unresolved doublet separated by 4 keV **
*^{52}Co T : average 17Ku12=111(4) 16Or08=112(3) 15Sh16=112(4) **
*^{52}Co^m T : average 16Or08=102(6) 13Su07=103(7) **
*^{52}Ni T : average 16Or03=42.8(3) 07Do17=40.8(2); other 94Fa06=38(5) **
*^{52}Ni D : %β^+p other 07Do17=31.4(15) 94Fa06=17.0(14) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{53}Ar	6790#	700#				20# ms >620ns	$5/2^-$#	11	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{53}K	−12300	110				30 ms 5	3/2$^+$	09	06Pe16	JD	1983	β^-=100;β^-n≈64 11; β^-2n≈10 5	*
^{53}Ca	−29390	40				461 ms 90	1/2$^-$#	14			1983	β^-=100;β^-n=40 10	*
^{53}Sc	−38770	18				2.4 s 0.6	(7/2$^-$)	14	10Cr02	TJ	1980	β^-=100;β^-n ?	
^{53}Ti	−46881.4	2.9				32.7 s 0.9	(3/2)$^-$	09			1977	β^-=100	
^{53}V	−51852	3				1.543 m 0.014	7/2$^-$	09			1960	β^-=100	
^{53}Cr	−55287.62	0.12				STABLE	3/2$^-$*	09			1930	IS=9.501 17	
^{53}Mn	−54690.3	0.3				3.7 My 0.4	7/2$^-$*	09			1955	ε=100	*
^{53}Mn^i	−47717	4	6973	4	RQ		3/2$^-$ T=5/2	09			1976		
^{53}Fe	−50947.5	1.7				8.51 m 0.02	7/2$^-$	09			1938	β^+=100	*
^{53}Fe^m	−47907.1	1.7	3040.4	0.3		2.54 m 0.02	19/2$^-$	09			1967	IT=100	
^{53}Fe^i	−46698	3	4250	3			7/2$^-$ T=3/2	09					
^{53}Co	−42659.4	1.7				244.6 ms 2.8	7/2$^-$#	09	17Ku12	T	1970	β^+=100	*
^{53}Co^m	−39485.1	1.9	3174.3	0.9	MD	250 ms 10	(19/2$^-$)	09	72Ce01	D	1970	β^+=?;p≈1.5	*
^{53}Co^i	−38334.4	2.6	4325.0	2.0	IT		(7/2$^-$) T=3/2	09	16Su10	ED	1976	IT≈100;p<0.9 3	
^{53}Ni	−29631	25				55.2 ms 0.7	(7/2$^-$)	13	16Su10	D	1976	β^+=100;β^+p=22.7 7	*
^{53}Cu	−13140#	500#				<130ns	3/2$^-$#	13				p ?	

*^{53}K J : from 20Su06 **
*^{53}Ca D : %β^-n 83La23=40(10)% is a lower limit **
*^{53}Mn J : 15Ba49,56Do45=7/2 **
*^{53}Fe T : other 18Tu03=8.47(0.19) 95Ir01=8.5(0.3) for q=26+ (bare ion) **
*^{53}Co T : average 17Ku12=245(3) 02Lo13=240(9) 89Ho13=240(20) 73Ko10=262(25); **
*^{53}Co T : values may contain small contribution from ^{53m}Co decay **
*^{53}Co^m D : %p from 72Ce01∼1.5 % **
*^{53}Co^m T : average 15Sh16=237(48) 76Vi02=260(20) 72Ce01=247(12) **
*^{53}Ni D : %β^+p average 16Su10=22(1) 07Do17=23.4(1.0); other: 76Vi02 45 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{54}Ar	12560#	800#				5# ms >400ns	0$^+$		18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{54}K	−5150#	400#				10 ms 5	2$^-$#	14			1983	β^-=100;β^-n ?;β^-2n ?	
^{54}Ca	−25160	50				90 ms 6	0$^+$	14	08Ma01	TD	1997	β^-=100;β^-n ?;β^-2n ?	*
^{54}Sc	−34438	14				526 ms 15	(3)$^+$	14			1990	β^-=100;β^-n=16 9	
^{54}Sc^m	−34328	14	110.5	0.3		2.77 μs 0.02	(5$^+$,4$^+$)	14	10Cr02	J	1998	IT=100	
^{54}Ti	−45744	16				2.1 s 1.0	0$^+$	14			1980	β^-=100	
^{54}V	−49898	11				49.8 s 0.5	3$^+$	14			1970	β^-=100	
^{54}V^m	−49790	11	108.0	1.0		900 ns 500	(5)$^+$	14			1998	IT=100	
^{54}Cr	−56935.38	0.13				STABLE	0$^+$	14			1930	IS=2.365 7	
^{54}Mn	−55558.2	1.0				312.081 d 0.032	3$^+$*	14	FGK204	T	1938	ε=100;β^-=0.93e-4; e$^+$=1.28e-7 25	*
^{54}Mn^i	−49411.9	2.8	6146.4	3.0	RQ		0$^+$ T=3						
^{54}Fe	−56254.6	0.3				STABLE	0$^+$	14			1923	IS=5.845 105;2β^+ ?	
^{54}Fe^m	−49727.5	1.1	6527.1	1.1		364 ns 7	10$^+$	14			1983	IT=100	
^{54}Fe^j	−41387	20	14868	20	RQ		0$^+$ T=3	14					
^{54}Co	−48010.1	0.4				193.27 ms 0.06	0$^+$ T=1	14	97Ko65	T	1952	β^+=100	*
^{54}Co^m	−47812.5	0.4	197.57	0.10	MD	1.48 m 0.02	7$^+$ T=0	14			1962	β^+=100	
^{54}Ni	−39278	5				114.1 ms 0.3	0$^+$	14	17Ku12	T	1977	β^+=100;β^+p ?	*
^{54}Ni^m	−32821	5	6457.4	0.9		152 ns 4	10$^+$	14	08Ru09	JD	2008	IT=64 2;p=36 2	
^{54}Cu	−21240#	400#				<75ns	3$^+$#	14	94Bl10	I		p ?	
^{54}Zn	−5700#	220#				1.8 ms 0.5	0$^+$	14	11As08	TD	2005	2p=87 7	*

*^{54}Ca T : average 10Cr02=107(14) 08Ma01=86(7) **
*^{54}Mn D : %e$^+$ average 98Wu01=1.20(0.26)e-7 97Za07=2.2(0.9)e-7 **
*^{54}Co T : average 97Ko65=193.28(0.07) 74Ha59=193.4(0.4) 74Ho21=193.0(0.3) **
*^{54}Co T : 77Al11=193.28(0.18); other (outweighed) 02Lo13=172(23) **
*^{54}Ni T : average 17Ku12=110(2) 15Mo01=114.2(0.3),114.3(1.8) 13Su07=113(9) **
*^{54}Ni T : 08Fu04=114(5) 02Lo13=103(9) 99Re06=106(12) **
*^{54}Zn T : symmetrized from 11As08=1.59(+0.60-0.35); other 05Bl15=3.2(+1.8-0.8) **
*^{54}Zn D : %2p average 11As08=92(+6-13)% 05Bl15=87(+10-17)% **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{55}K	470#	500#				10# ms >620ns	3/2$^+$#	09	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{55}Ca	−18650	160				22 ms 2	5/2$^-$#	09			1997	β^-=100;β^-n ?;β^-2n ?	
^{55}Sc	−30840	60				96 ms 2	(7/2)$^-$	08	10Cr02	TJD	1990	β^-=100;β^-n=17 7;β^-2n ?	*
^{55}Ti	−41832	29				1.3 s 0.1	(1/2)$^-$	10			1980	β^-=100;β^-n ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{55}V	−49125	27				6.54	s	0.15	7/2−#	08			1977	β^-=100	
^{55}Cr	−55110.32	0.23				3.497	m	0.003	3/2−	08			1952	β^-=100	
^{55}Mn	−57712.54	0.26				STABLE			5/2−*	08			1923	IS=100	*
^{55}Fe	−57481.4	0.3				2.7562	y	0.0004	3/2−	09	FGK204	T	1939	ε=100	
^{55}Fe^{i}	−49848	6	7633	6	RQ				5/2− T=5/2	09					
^{55}Co	−54030.0	0.4				17.53	h	0.03	7/2−*	09			1938	β^+=100	
^{55}Co^{i}	−49308.6	0.4	4721.44	0.10					3/2− frg. T=3/2	09			1981	IT=100	*
^{55}Ni	−45336.0	0.7				203.9	ms	1.3	7/2−	08	17Ku12	T	1972	β^+=100	*
^{55}Ni^{i}	−40737.0	1.2	4599	1					7/2− frg. T=3/2		13Tr09	E			*
^{55}Cu	−31640	160				55.9	ms	1.5	3/2−#	08	13Tr09	T	1987	β^+=100;β^+p=?	*
^{55}Zn	−14270#	400#				19.8	ms	1.3	5/2−#	08	07Do17	TD	2001	β^+=100;β^+p=91.0 51	
*^{55}Sc	T : others 04Li75=115(15) 02Sh43=103(7) 98So03=120(40)														**
*^{55}Mn	J : 15Ba49,15He28,79De19=5/2														**
*^{55}Co^{i}	E : strongly fragmented state; other 26.69(0.15) keV higher														**
*^{55}Ni	T : average 17Ku12=203(2) 02Lo13=196(5) 99Re06=204(3) 87Ha.A=212.1(3.8)														**
*^{55}Ni	T : 84Ay01=208(5) 77Ho25=189(5) 76Ed.A=219(6)														**
*^{55}Ni	J : l=3 in 14Sa46														**
*^{55}Ni^{i}	E : strongly fragmented state; other 20 keV lower														**
*^{55}Cu	T : average 20Gi02=55.5(1.8) 13Tr09=57(3); other 07Do17=27(8), conflicting														**
*^{55}Cu	D : %β^+p in 07Do17=15.0(4.3), but it is probably a contaminant given the														**
*^{55}Cu	D : short and conflicting half-life; not confirmed in 13Tr09														**
^{56}K	7980#	600#				5#	ms	>620ns	2−#	11	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{56}Ca	−13510	250				11	ms	2	0+	11			1997	β^-=100;β^-n ?;β^-2n ?	
^{56}Sc	−25520	260			*	26	ms	6	(1+)	11	10Cr02	JT	1997	β^-=100;β^-n ?;β^-2n ?	
^{56}Sc^{m}	−25520#	280#	0#	100#	*	75	ms	6	(6+,5+)	11	10Cr02	JTD	2004	β^-=100;β^-n>12;β^-2n ?	
^{56}Sc^{n}	−24750	260	775.0	0.1		290	ns	17	(4+)	11	20Mi13	TE	2004	IT=100	*
^{56}Ti	−39420	100				200	ms	5	0+	11	98Am04	D	1980	β^-=100;β^-n ?	
^{56}V	−46180	180				216	ms	4	(1+)	11	98Am04	D	1980	β^-=100;β^-n ?	
^{56}Cr	−55285.1	0.6				5.94	m	0.10	0+	11	60Dr03	D	1960	β^-=100	
^{56}Mn	−56911.67	0.29				2.5789	h	0.0001	3+*	11			1934	β^-=100	
^{56}Fe	−60607.16	0.27				STABLE			0+	11			1923	IS=91.754 106	
^{56}Fe^{i}	−49103.5	0.4	11503.7	0.3					3+ T=3	11					
^{56}Co	−56040.5	0.5				77.236	d	0.026	4+*	11			1941	β^+=100	
^{56}Co^{i}	−52448	9	3593	9	RQ				(0+) frg. T=2	11					*
^{56}Ni	−53907.6	0.4				6.075	d	0.010	0+	11			1952	β^+=100	
^{56}Ni^{p}	−44172.1	1.9	9735.5	1.9					7	11			2008	p≈100	
^{56}Ni^{i}	−47475.7	0.8	6431.9	0.7					4+ T=1	11					
^{56}Ni^{j}	−43964	4	9944	4	RQ				0+ frg. T=2						*
^{56}Cu	−38630	6				80.8	ms	0.6	(4+)	11	01Bo54	TJD	1987	β^+=100;β^+p=0.40 12	*
^{56}Cu^{i}	−35099	10	3531	12	p				T=2		16Or03	D	2007	IT=51 6;p=49 6	
^{56}Zn	−25390#	400#				32.4	ms	0.7	0+	11	14Or04	TD	2001	β^+=100;β^+p=88.0 23	*
^{56}Zn^{i}	−21530#	650#	3860#	510#					3+# T=3					p ?	
^{56}Ga	−3840#	500#							3+#					p ?	
*^{56}Sc^{n}	T : average 20Mi13=290(20) 10Cr02=290(30); other 12Ka36=350(+260-120)														**
*^{56}Co^{i}	E : strongly fragmented state; other 70(9) keV lower														**
*^{56}Ni^{j}	E : strongly fragmented state; others 68(6) and 98(6) keV higher														**
*^{56}Cu	T : average 20Gi02=80.2(7) 17Ku12=80(2) 02Lo13=82(9) 01Bo54=93(3)														**
*^{56}Cu	T : 98Ra15=78(15)														**
*^{56}Zn	T : average 14Or04=32.9(0.8) 07Do17=30.0(1.7)														**
*^{56}Zn	D : %β^+p average 14Or04=88.5(26) 07Do17=86.0(49)														**
^{57}K	14130#	600#				2#	ms	>400ns	3/2+#		18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{57}Ca	−6560#	400#				8#	ms	>620ns	5/2−#	10	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{57}Sc	−21380	180				22	ms	2	7/2−#	10	10Cr02	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{57}Ti	−34400	210				95	ms	8	5/2−#	10	99So20	T	1985	β^-=100;β^-n ?	*
^{57}V	−44440	80				350	ms	10	(7/2−)	10	03Ma02	T	1980	β^-=100;β^-n ?	*
^{57}Cr	−52525.0	1.9				21.1	s	1.0	(3/2)−	10			1978	β^-=100	
^{57}Mn	−57486.3	1.5				85.4	s	1.8	5/2−*	98	15Ba49	J	1954	β^-=100	
^{57}Fe	−60182.02	0.27				STABLE			1/2−*	98			1935	IS=2.119 29	
^{57}Co	−59345.7	0.5				271.811	d	0.032	7/2−*	98	FGK204	T	1941	ε=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{57}Co^{i}	−52092.3	0.4	7253.3	0.6	RQ				$1/2^-$ T=5/2		MMC120J				
^{57}Ni	−56084.0	0.6				35.60	h	0.06	$3/2^-$	98			1938	β^+=100	
^{57}Ni^{i}	−50845.2	0.9	5238.8	0.7					$7/2^-$ frg. T=3/2	98					*
^{57}Cu	−47309.0	0.5				196.4	ms	0.7	$3/2^-$*	98	17Ku12	T	1976	β^+=100	*
^{57}Cu^{i}	−42010	25	5299	25	p				$7/2^-$ T=3/2						
^{57}Zn	−32550#	200#				45.7	ms	0.6	$7/2^-$#	98	20Gi02	T	1976	β^+=100;β^+p=87 9	*
^{57}Ga	−15410#	400#							$1/2^-$#					p ?	
*^{57}Sc	T : other 03So21=13(4)														**
*^{57}Ti	T : average 05Li53=98(5) 99So20=67(25) 96Do23=56(20); other														**
*^{57}Ti	T : 98Am04=180(30) conflicting, not used														**
*^{57}V	J : 98So03 proposed 3/2-, supported in 03Ma02; same group 05Li53 favors 7/2-														**
*^{57}Ni^{i}	E : strongly fragmented state; others 98(7) keV lower 128(7) keV higher														**
*^{57}Ni^{i}	E : in 79Ik04 and 104(5) keV lower, 129(5) keV higher in 78Na11														**
*^{57}Cu	T : average 17Ku12=195(4) 02Lo13=183(17) 96Se01=196.3(0.7)														**
*^{57}Cu	T : 87Ha.A=199.4(3.2) 84Sh28=223(16)														**
*^{57}Cu	J : 10Co01=3/2														**
*^{57}Zn	T : others (outweighed) 07Bl09=48(3) 02Lo13=37(5) 76Vi02=40(10)														**
*^{57}Zn	D : %β^+p average 20Ci04=90(10) 07Bl09=78(17)														**
^{58}K	21930#	700#				2#	ms	>400ns	2^-#		18Ta17	I	2019	β^- ?;β^-n ?;β^-2n ?	
^{58}Ca	−1530#	500#				4#	ms	>620ns	0^+	10	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{58}Sc	−15480	190				12	ms	5	3^+#	10			1997	β^-=100;β^-n ?;β^-2n ?	
^{58}Sc^{m}	−14060	190	1420.7	2.2		0.60	μs	0.13			20Mi13	ET	2020	IT=100	*
^{58}Ti	−30920	180				55	ms	6	0^+	14	11Da08	T	1992	β^-=100;β^-n ?	*
^{58}V	−40430	100				191	ms	10	(1^+)	10			1980	β^-=100;β^-n ?	
^{58}Cr	−51991.8	3.0				7.0	s	0.3	0^+	10			1980	β^-=100	
^{58}Mn	−55827.6	2.7				3.0	s	0.1	1^+*	10	15He28	J	1961	β^-=100	
^{58}Mn^{m}	−55755.8	2.7	71.77	0.05		65.4	s	0.5	4^+*	10	15He28	J	1961	$\beta^-\approx$100;IT ?	
^{58}Fe	−62155.3	0.3				STABLE			0^+	10			1935	IS=0.282 12	
^{58}Co	−59847.3	1.2				70.844	d	0.020	2^+*	10	FGK204	T	1941	β^+=100;e$^+$=14.79 24; ε=85.21 24	*
^{58}Co^{m}	−59822.4	1.2	24.95	0.06		8.853	h	0.023	5^+	10	19Mo11	TD	1950	IT=99.99880 5; ε=0.00120 5	
^{58}Co^{n}	−59794.2	1.2	53.15	0.07		10.5	μs	0.3	4^+	10			1964	IT=100	
^{58}Co^{i}	−54095	8	5752	8	RQ				0^+ frg. T=3	10					*
^{58}Ni	−60228.9	0.3				STABLE		>700Ey	0^+	10	93Va19	T	1921	IS=68.0769 190;2β^+ ?	
^{58}Ni^{i}	−51400	40	8830	40	RQ				2^+ T=2	10					
^{58}Ni^{j}	−45690	7	14539	7	RQ				0^+ T=3	10	MMC12	J			
^{58}Cu	−51667.9	0.6				3.204	s	0.007	1^+* T=0	10	11Vi03	J	1952	β^+=100	*
^{58}Cu^{i}	−51464.9	0.6	202.99	0.24					0^+ T=1	10					
^{58}Zn	−42300	50				86.0	ms	1.9	0^+	14	20Ci04	D	1986	β^+=100;β^+p=0.7 1	*
^{58}Ga	−23540#	300#			*				2^+#		Mirror	I		p ?	
^{58}Ga^{m}	−23510#	320#	30#	100#	*				5^+#		Mirror	I		p ?	
^{58}Ge	−7580#	500#							0^+		Mirror	I		2p ?	
*^{58}Sc^{m}	T : average 20Mi13=0.6(0.2) 1.3(0.8) 0.9(0.5) 0.5(0.2) from γ(t)														**
*^{58}Sc^{m}	E : 20Mi13=180.5(0.6), 247(2), 412.3(0.6), 580.9(0.4) gammas in a cascade														**
*^{58}Ti	T : average 11Da08=57(10) 03So21=59(9) 99So20=47(10)														**
*^{58}Co	D : from 71GoYM														**
*^{58}Co^{i}	E : strongly fragmented state; other 20(8) keV lower														**
*^{58}Cu	J : also 10Co01=1														**
*^{58}Zn	T : average 17Ku12=86(2) 09Fu15=90(8) 05Ka46=83(10) 02Lo13=83(10)														**
*^{58}Zn	T : 98Jo18=86(18)														**
^{59}K	28750#	800#				1#	ms	>400ns	$3/2^+$#		18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{59}Ca	5810#	600#				5#	ms	>400ns	$5/2^-$#		18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{59}Sc	−10830	250				12#	ms	>620ns	$7/2^-$#	18	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{59}Ti	−25880#	300#				28.5	ms	1.9	$5/2^-$#	18	11Da08	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{59}Ti^{m}	−25770#	300#	108.5	0.5		615	ns	11	$1/2^-$#	18	19Wi04	TJE	2012	IT=100	*
^{59}V	−37610	140				95	ms	6	$(5/2^-)$	18	05Li53	TJD	1985	β^-=100;β^-n>3	*
^{59}Cr	−48115.9	0.7				1050	ms	90	$(1/2^-)$	18	05Li53	TJ	1980	β^-=100	*
^{59}Cr^{m}	−47613.2	1.3	502.7	1.1		96	μs	20	$(9/2^+)$	18			1998	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{59}Mn	−55525.3	2.3				4.59	s	0.05	$5/2^{-}*$	18	15Ba49	J	1976	β^{-}=100	
^{59}Fe	−60665.0	0.3				44.500	d	0.012	$3/2^{-}*$	18	FGK204	T	1938	β^{-}=100	
^{59}Co	−62229.8	0.4				STABLE			$7/2^{-}*$	18			1923	IS=100	
^{59}Ni	−61156.8	0.4				81	ky	5	$3/2^{-}$	18	94Ru19	T	1951	β^{+}=100	*
^{59}Ni^{i}	−53814.9	2.1	7341.9	2.1	RQ				$7/2^{-}$ frg. T=5/2						*
^{59}Cu	−56358.5	0.5				81.5	s	0.5	$3/2^{-}*$	18			1947	β^{+}=100	*
^{59}Cu^{i}	−52473.0	2.2	3885.5	2.1					$3/2^{-}$ frg. T=3/2	18				IT=100	*
^{59}Zn	−47215.7	0.8				178.7	ms	1.3	$3/2^{-}$	18			1981	β^{+}=100;β^{+}p=0.10 2	*
^{59}Ga	−33760#	170#						<43ns	$3/2^{-}$#	18				p ?	
^{59}Ge	−16370#	400#				13.3	ms	1.7	$7/2^{-}$#	18	20Gi02	TD	2015	$\beta^{+}\approx$100;β^{+}p=93 7;2p<0.2	*

*^{59}Ti T : average 11Da08=27.5(2.5) 03So21=30(3); other 99So20=58(17) **
*^{59}Ti^{m} T : average 20Mi13=610(20) 19Wi04=618(13) 12Ka36=587(+57-51); other **
*^{59}Ti^{m} T : 05Ga01=590(130) **
*^{59}Ti^{m} E : other 20Mi13=108.9(0.4) **
*^{59}V T : average 05Li53=97(2) 99So20=75(7) (supersedes 98So03=70(40)); other **
*^{59}V T : 98Am04=130(20) conflicting, not used **
*^{59}Cr T : others 96Do23=460(50), 88Bo06=600(300), 85Bo49=1000(400) **
*^{59}Ni T : average 94Ru19=108(13) 94Ru19(meteorite)=120(22) 81Ni08=76(5) **
*^{59}Ni^{i} E : strongest fragmented state; others 40.1(0.3) keV higher, 17.7(0.3) keV **
*^{59}Ni^{i} E : higher and 36.3(0.2)keV lower **
*^{59}Cu J : 11Vi03,11Ko36,10Co01=3/2 **
*^{59}Cu^{i} E : strongest fragmented state; other 21(6) keV higher **
*^{59}Zn T : average 17Ku12=174(2) 14Ro14=210(34) 02Lo13=173(14) **
*^{59}Zn T : 84Ar12=182.2(1.8) 81Ho19=210(20) **
*^{59}Ge T : other 16Go26 (same as 20Gi02) **
*^{59}Ge D : 2p not observed in 20Gi02 and 16Go26; limit from 16Go26 based on the **
*^{59}Ge D : assumption that one event is not β^{+}p **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{60}Ca	11000#	700#				2#	ms	>400ns	0^{+}		18Ta17	I	2018	β^{-} ?;β^{-}n ?;β^{-}2n ?	
^{60}Sc	−4550#	500#				10#	ms	>620ns	3^{+}#		09Ta24	I	2009	β^{-} ?;β^{-}n ?;β^{-}2n ?	
^{60}Ti	−22100	240				22.2	ms	1.6	0^{+}	14	11Da08	T	1997	β^{-}=100;β^{-}n ?;β^{-}2n ?	*
^{60}V	−33090	180			*	122	ms	18	3^{+}#	13			1985	β^{-}=100;β^{-}n ?;β^{-}2n ?	
^{60}V^{m}	−33090#	230#	0#	150#	*	40	ms	15	1^{+}#	13			1999	β^{-}=?;IT ?;β^{-}n ?;β^{-}2n ?	
^{60}V^{n}	−32890	180	203.7	0.7		230	ns	24	(4^{+})	13	12Ka36	ET	1999	IT=100	*
^{60}Cr	−46908.5	1.1				490	ms	10	0^{+}	13			1980	β^{-}=100;β^{-}n ?	
^{60}Mn	−52967.9	2.3				280	ms	20	$1^{+}*$	13	15He28	J	1978	β^{-}=100	
^{60}Mn^{m}	−52696.0	2.3	271.90	0.10		1.77	s	0.02	$4^{+}*$	13	15He28	J	1978	β^{-}=88.5 8;IT=11.5 8	*
^{60}Fe	−61413	3				2.62	My	0.04	0^{+}	13	09Ru08	T	1957	β^{-}=100	*
^{60}Co	−61650.4	0.4				5.2714	y	0.0006	$5^{+}*$	13	FGK204	T	1941	β^{-}=100	
^{60}Co^{m}	−61591.8	0.4	58.59	0.01		10.467	m	0.006	$2^{+}*$	13			1963	IT$\approx$100;β^{-}=0.25 3	
^{60}Ni	−64473.2	0.4				STABLE			0^{+}	13			1921	IS=26.2231 150	
^{60}Ni^{i}	−53347	4	11126	4	RQ				5^{+} T=3						
^{60}Cu	−58345.3	1.6				23.7	m	0.4	$2^{+}*$	13	11Vi03	J	1947	β^{+}=100	
^{60}Cu^{i}	−55804	5	2541	5	RQ				(0^{+}) T=2	13				IT=100	
^{60}Zn	−54174.5	0.5				2.38	m	0.05	0^{+}	13			1955	β^{+}=100	
^{60}Zn^{i}	−49322.3	0.9	4852.2	0.7					(2^{+}) T=1	13				IT=100	
^{60}Zn^{j}	−46807	24	7367	24	RQ				0^{+} T=2	13					
^{60}Ga	−39590#	200#				72.4	ms	1.7	(2^{+})	13	20Gi02	T	1995	β^{+}=100;β^{+}p=1.6 7; $\beta^{+}\alpha$<0.023 20	*
^{60}Ga^{i}	−37050#	210#	2540#	50#											
^{60}Ge	−27530#	300#				21	ms	6	0^{+}	13	16Ci01	TD	2005	β^{+}=100;β^{+}p$\approx$100;β^{+}2p<14	*
^{60}As	−5640#	400#							5^{+}#		Mirror	I		p ?	
^{60}As^{m}	−5580#	400#	60#	20#					2^{+}#		Mirror	I		p ?	

*^{60}Ti T : average 11Da08=22.4(2.5) 03So21=22(2) **
*^{60}V^{n} E : 12Ka36=99.7(0.5) and 104.0(0.5) gamma rays in a cascade to gs **
*^{60}V^{n} T : symetrized from 12Ka36=229(+25-23); others 10Da06=320(90) 99Da.A=320(90) **
*^{60}Mn^{m} I : other isomer T=1.0(+0.3-0.2) us decays by 114 keV g-ray (not placed) **
*^{60}Fe T : adopted from 09Ru08; others: 17Os02=2.72(0.16) 15Wa06=2.50(0.12) **
*^{60}Ga T : average 20Gi02=70.8(2.0) 17Ku12=76(3); others 02Lo13=70(13) **
*^{60}Ga T : 01Ma96=70(15), outweighed **
*^{60}Ge T : symmetrized from 16Ci01=20(+7-5) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{61}Ca	19010#	800#				1#	ms		$1/2^-$#					β^- ?;β^-n ?;β^-2n ?	
^{61}Sc	500#	600#				7#	ms	>620ns	$7/2^-$#	15	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{61}Ti	−16370#	300#				15	ms	4	$1/2^-$#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{61}Ti^m	−16250#	300#	125.0	0.5		200	ns	28	$5/2^-$#	15	19Wi04	TEJ	2019	IT=100	*
^{61}Ti^n	−15670#	300#	700.1	0.7		354	ns	69	$9/2^+$#	15	19Wi04	TEJ	2019	IT=100	*
^{61}V	−30180	230				48.2	ms	0.6	$(3/2^-)$	15	20On01	TDJ	1992	β^-=100;β^-n=14.5 20; β^-2n ?	*
^{61}Cr	−42496.5	1.9				243	ms	9	$(5/2^-)$	15	09Cr02	T	1985	β^-=100;β^-n ?	
^{61}Mn	−51742.1	2.3				709	ms	8	$5/2^-$*	15	15Ba49	J	1980	β^-=100;β^-n ?	*
^{61}Fe	−58920.5	2.6				5.98	m	0.06	$(3/2^-)$	15			1957	β^-=100	
^{61}Fe^m	−58058.8	2.6	861.67	0.11		238	ns	5	$9/2^+$	15			1998	IT=100	
^{61}Co	−62898.2	0.8				1.649	h	0.005	$7/2^-$	15			1947	β^-=100	
^{61}Ni	−64222.0	0.4				STABLE			$3/2^-$*	15			1934	IS=1.1399 13	
^{61}Cu	−61984.1	1.0				3.343	h	0.016	$3/2^-$*	15			1937	β^+=100	*
^{61}Cu^i	−55611	7	6373	7	RQ				$3/2^-$ frg. T=5/2						*
^{61}Zn	−56349	16				89.1	s	0.2	$3/2^-$	15			1955	β^+=100	
^{61}Zn^i	−53190#	100#	3160#	100#					$3/2^-$# T=3/2						
^{61}Zn^j	−46360	70	9990	70					$3/2^-$ T=5/2	15					
^{61}Ga	−47130	40				165.9	ms	2.5	$3/2^-$	15	17Ku12	T	1987	β^+=100;β^+p<0.25	*
^{61}Ga^m	−47040#	110#	90#	100#					$1/2^-$#		Mirror	I			
^{61}Ga^i	−43780	30	3360	50	p				$(3/2^-)$ T=3/2	15			1987	p=100	
^{61}Ge	−33790#	300#				40.7	ms	0.4	$3/2^-$#	15	20Gi02	TD	1987	β^+=100;β^+p=87 3	
^{61}As	−17200#	300#							$3/2^-$#		Mirror	I		p ?	

*^{61}Ti^m E : other 20Mi13=125.2(0.6) **
*^{61}Ti^m T : other 20Mi13=300(100) **
*^{61}Ti^n E : other 20Mi13=701.3(0.7) **
*^{61}Ti^n T : other 20Mi13=200(100) **
*^{61}V T : average 20On01=48(1) 14Su07=49(1) 11Da08=52.6(4.2) 03So02=47.0(1.2), **
*^{61}V T : supersedes 99So20=43(7) **
*^{61}Mn D : β^-n observed by 99Ha05; 13Ra17 quotes %β^-n=0.6(0.1) (unpublished) **
*^{61}Cu T : average 15Cv01=3.323(0.010) 82Gr10=3.333 (0.005) 72Cr02=3.34(0.01) **
*^{61}Cu T : 69Ri04=3.408(0.010); Birge ratio 4.1 **
*^{61}Cu^i E : strongly fragmented state; other 18(7) keV higher **
*^{61}Ga T : average 17Ku12=163(5) 14Ro14=162(10) 02We07=168(3) 02Lo13=148(19) **
*^{61}Ga T : 99Oi01=140(70) 93Wi18=150(30) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{62}Sc	7310#	600#				2#	ms	>400ns			18Ta17	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{62}Ti	−12200#	400#				9#	ms	>620ns	0^+	12	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{62}V	−25210	260				33.6	ms	2.3	3^+#	12			1997	β^-=100;β^-n ?;β^-2n ?	
^{62}Cr	−40853	3				206	ms	12	0^+	12			1985	β^-=100;β^-n ?	
^{62}Mn	−48524	7			*	92	ms	13	1^+*	12	15He28	J	1983	β^-=100;β^-n ?	*
^{62}Mn^m	−48181.0	2.6	343	6	*	671	ms	5	4^+*	12	15He28	J	1983	β^-=100;β^-n ?;IT ?	*
^{62}Fe	−58878.1	2.8				68	s	2	0^+	12			1975	β^-=100	
^{62}Co	−61424	19				1.54	m	0.10	$(2)^+$	12			1949	β^-=100	
^{62}Co^m	−61402	20	22	5		13.86	m	0.09	$(5)^+$	12	70Jo12	D	1957	$\beta^-\approx$100;IT<0.5	
^{62}Ni	−66746.4	0.4				STABLE			0^+	12			1934	IS=3.6345 40	
^{62}Cu	−62787.5	0.6				9.672	m	0.008	1^+*	12	14Un01	T	1936	β^+=100	
^{62}Cu^i	−58174	6	4614	6	RQ				$(0)^+$ T=3	12					*
^{62}Zn	−61168.1	0.6				9.193	h	0.015	0^+	12			1948	β^+=100	
^{62}Ga	−51987.0	0.6				116.122	ms	0.021	0^+ T=1	12	13Da16	T	1978	β^+=100	*
^{62}Ga^j	−51415.8	0.6	571.2	0.1					$1(^+)$ T=2	12	98Vi06	EJ	1998	IT=100	
^{62}Ge	−42140#	140#				82.5	ms	1.4	0^+	12	17Ku12	T	1991	β^+=100;β^+p ?	*
^{62}As	−24420#	300#							1^+#					p ?	*

*^{62}Mn D : %β^-n 99So20∼0 99Ha05>0 **
*^{62}Mn^m E : symmetrized from 15Ga38=346(+3-8) keV **
*^{62}Cu^i E : Ensdf2012=4628(10) keV **
*^{62}Ga T : average 13Da16=116.15(0.13) 08Gr03=116.100(0.025) 05Hy04=116.01(0.19) **
*^{62}Ga T : 05Ca06=116.09(0.17) 04Bl03=116.19(0.04) 03Hy02=115.84(0.25) **
*^{62}Ga T : 79Da04=116.34(0.35) 78Al23=115.95(0.30); others (outweighed) **
*^{62}Ga T : 02Bl17,02Lo13=114(2) 78Ch11=116.4(1.5) 93Wi03,93Wi18=113(+6-5) **
*^{62}Ga T : 93Wi03,93Wi18=113(+6-5) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{62}Ge	T : average 14Gr10=82.9(1.4) 17Ku12=76(6)														**
*^{62}As	D : most likely p-unstable from estimated Sp=-1980#(420#) keV														**
^{63}Sc	13070#	700#				1#	ms		$7/2^-$#					β^- ?;β^-n ?;β^-2n ?	
^{63}Ti	−5860#	500#				10#	ms	>620ns	$1/2^-$#	09	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{63}V	−21740	340				19.6	ms	0.9	$(3/2^-,5/2^-)$	09	14Su07	TJ	1997	β^-=100;β^-n>35;β^-2n ?	*
^{63}Cr	−36180	70				129	ms	2	$1/2^-$#	09			1992	β^-=100;β^-n ?	*
^{63}Mn	−46887	4				275	ms	4	$5/2^-$*	09	15Ba49	J	1985	β^-=100;β^-n= ?	*
^{63}Fe	−55636	4				6.1	s	0.6	$(5/2^-)$	09			1980	β^-=100	
^{63}Co	−61852	19				26.9	s	0.4	$7/2^-$	09	94It.A	T	1960	β^-=100	*
^{63}Ni	−65512.9	0.4				101.2	y	1.5	$1/2^-$*	09	17Dy01	J	1951	β^-=100	*
^{63}Ni^m	−65425.8	0.4	87.15	0.11		1.67	μs	0.03	$5/2^-$	09			1978	IT=100	
^{63}Cu	−65579.9	0.4				STABLE			$3/2^-$*	09			1923	IS=69.15 15	*
^{63}Zn	−62213.4	1.6				38.47	m	0.05	$3/2^-$*	09			1937	β^+=100	*
^{63}Zn^i	−56723	6	5490	6	RQ				$3/2^-$ T=5/2	09					
^{63}Ga	−56547.1	1.3				32.4	s	0.5	$3/2^-$*	09	12Pr11	J	1965	β^+=100	
^{63}Ge	−46920	40				153.6	ms	1.1	$3/2^-$#	09	20Gi02	T	1991	β^+=100;β^+p ?	*
^{63}As	−33500#	200#						<43ns	$3/2^-$#	09	05St29	I		p ?	*
^{63}Se	−16850#	500#				13.2	ms	3.9	$3/2^-$#		20Gi02	TD	2016	β^+=100;β^+p=89 11;2p<0.5	*
*^{63}V	T : average 14Su07=20(1) 11Da08=19.2(2.4) 03So02=17(3)														**
*^{63}Cr	T : other 11Da08=128(8)														**
*^{63}Mn	D : β^-n observed by 99Ha05, but not quantified														**
*^{63}Co	T : average 94It.A=26.41(0.27) 72Jo08=27.5(0.3) 69Wa15=26(1)														**
*^{63}Ni	J : 17Dy01=1/2														**
*^{63}Cu	J : also 20De21,10Vi07,11Ko36,10Co01=3/2														**
*^{63}Zn	J : also 17Wr01=3/2														**
*^{63}Ge	T : from 20Gi02, supersedes 19Ru.A=153.3(0.6) (same collaboration);														**
*^{63}Ge	T : others: 17Ku12=156(11) 14Ro14=149(4) 02Lo13=150(9) 93Wi03=95(+23-20)														**
*^{63}As	D : most likely p-unstable from estimated Sp=-950#(240#) keV														**
*^{63}Se	T : other 16Go26 (same as 20Gi02)														**
*^{63}Se	D : 2p not observed in 20Gi02 and 16Go26; limit from 16Go26 based on the														**
*^{63}Se	D : assumption that one event is not β^+p														**
^{64}Ti	−1480#	600#				5#	ms	>620ns	0^+	13	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{64}V	−16320#	400#				15	ms	2	$(1,2)$	14			1997	β^-=100;β^-n ?;β^-2n ?	
^{64}V^m	−16240#	400#	81.0	0.7		< 1	μs			14			2014	IT≈100	
^{64}Cr	−33640	300				43	ms	1	0^+	14			1992	β^-=100;β^-n ?	
^{64}Mn	−42989	4				88.8	ms	2.4	1^+*	07	12Pa39	D	1985	β^-=100;β^-n=2.7 6	*
^{64}Mn^m	−42815	4	174.1	0.5		439	μs	31	(4^+)*	07	10Da06	E	1998	IT=100	*
^{64}Fe	−54970	5				2.0	s	0.2	0^+	07			1980	β^-=100	
^{64}Co	−59792	20				300	ms	30	1^+	07			1969	β^-=100	
^{64}Co^m	−59686	4	107	20	MD	300#	ms		5^+#		08Bl05	E	2008	β^- ?;IT ?	
^{64}Ni	−67099.0	0.5				STABLE			0^+	07			1935	IS=0.9256 19	
^{64}Cu	−65424.4	0.4				12.7004	h	0.0013	1^+*	07	FGK204	T	1936	β^+=61.52 26;β^-=38.48 26	*
^{64}Cu^i	−58598	6	6826	6					0^+ frg. T=4	07	71Be29	E			*
^{64}Zn	−66004.0	0.6				STABLE		>60Py	0^+	07	03Ki08	T	1922	IS=49.17 75;2β^+ ?	*
^{64}Ga	−58832.8	1.4				2.627	m	0.012	$0(^+$#)	07			1953	β^+=100	
^{64}Ga^m	−58790.0	1.4	42.85	0.08		21.9	μs	0.7	(2^+)	07			1999	IT=100	
^{64}Ga^i	−56925.8	2.5	1907.0	2.2	RQ				(0^+) T=2	07					
^{64}Ge	−54316	4				63.7	s	2.5	0^+	07			1972	β^+=100	
^{64}As	−39530#	200#				69.0	ms	1.4	0^+#	07	20Gi02	T	1995	β^+=100;β^+p ?	*
^{64}Se	−26860#	500#				22.6	ms	0.2	0^+	07	19Ru.A	T	2005	β^+ ?;β^+p ?	
*^{64}Mn	T : average 11Da08=90(9) 02So.A=91(4) 99So20=85(5) 99Ha05=89(4)														**
*^{64}Mn	J : 15He28=1														**
*^{64}Mn	D : %β^-n other 00HaZL=33(2)														**
*^{64}Mn^m	J : 15He28=(4)														**
*^{64}Mn^m	T : average 11Li50=400(40) 05Ga.B=500(50)														**
*^{64}Cu	J : 20De21,10Vi07=1														**
*^{64}Cu	D : from 12Be24														**
*^{64}Cu^i	E : strongest fragment (xs=100); other 16 keV lower (xs=37)														**
*^{64}Zn	T : for 2nu-$\varepsilon\varepsilon$														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{64}As	T : from 20Gi02, supersedes 19Ru.A=63.4(1.2) (same collaboration);														**
*^{64}As	T : others 14Ro14=72(6) 02Lo13=18(+43-7)														**
^{65}Ti	5210#	700#				1#	ms		1/2−#					β^- ?;β^-n ?;β^-2n ?	
^{65}V	−12110#	500#				14#	ms	>620ns	5/2−#	10	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{65}Cr	−28310#	200#				27.5	ms	2.1	1/2−#	10	11Da08	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{65}Mn	−40967	4				91.9	ms	0.7	(5/2−)	10	13Ol06	TJD	1985	β^-=100;β^-n=7.9 12	*
^{65}Fe	−51218	5				805	ms	10	(1/2−)	10	13Ol06	TD	1980	β^-=100;β^-n ?	*
^{65}Fe^m	−50824	5	393.7	0.2		1.12	s	0.15	(9/2+)	10	13Ol06	E	2008	β^- ?	
^{65}Fe^n	−50820	5	397.6	0.2		418	ns	12	(5/2+)	10	13Ol06	EJ	1998	IT=100	*
^{65}Co	−59185.2	2.1				1.16	s	0.03	(7/2)−	10			1978	β^-=100	
^{65}Ni	−65125.8	0.5				2.5175	h	0.0005	5/2−	10			1946	β^-=100	
^{65}Ni^m	−65062.4	0.5	63.37	0.05		69	μs	3	1/2−	10			1978	IT=100	
^{65}Cu	−67263.7	0.6				STABLE			3/2−*	10	10Vi07	J	1923	IS=30.85 15	*
^{65}Zn	−65912.0	0.6				243.94	d	0.04	5/2−*	10	FGK204	T	1939	β^+=100	*
^{65}Zn^m	−65858.1	0.6	53.928	0.010		1.6	μs	0.6	1/2−	10	FGK149	J	1960	IT=100	*
^{65}Ga	−62657.5	0.8				15.133	m	0.028	3/2−*	10	19Gy04	T	1938	β^+=100	*
^{65}Ge	−56478.2	2.2				30.9	s	0.5	3/2−	10			1972	β^+=100;β^+p=0.011 3	
^{65}As	−46940	80				130.3	ms	0.6	3/2−#	10	20Gi02	T	1991	β^+=100;β^+p ?	*
^{65}As^i	−43452	11	3490	90	p				(3/2−) T=3/2	10	11Ro47	J	1993	p=100	*
^{65}Se	−33020#	300#				34.2	ms	0.7	3/2−#	10	20Gi02	T	1993	β^+=100;β^+p=87 13	*
^{65}Br	−16490#	500#						<410ns	5/2−#		16Bl05	I		p ?	
*^{65}Cr	T : average 11Da08=28(3) 03So21=27(3)														**
*^{65}Mn	T : average 13Ol06=91.9(0.9) 03So21=92(1); other (recent) 11Da08=84(8),														**
*^{65}Mn	T : outweighed (not used)														**
*^{65}Mn	D : other β^-n observed by 99Ha05, but not quantified														**
*^{65}Fe	T : 19Ol02=805(10). others 09Pa16=810(50) 99So20=1320(280)														**
*^{65}Fe	T : 95Am.A=760(50) supersedes 94Cz02=450(150)														**
*^{65}Fe^n	E : other 10Da06=396.8, uncertainty not given, 98Gr14=364(3)														**
*^{65}Fe^n	T : average 18St18=409(+29-27) 10Da06=420(13)														**
*^{65}Cu	J : 20De21,10Vi07,10Co01=3/2														**
*^{65}Zn	J : also 17Wr01=5/2														**
*^{65}Zn^m	J : E2 to 5/2-														**
*^{65}Ga	T : from 19Gy04=15.133 (0.016 stat) (0.023 syst); other 57Da07=15.2(0.2)														**
*^{65}Ga	J : 17Fa09=3/2														**
*^{65}As	T : others (outweighed) 14Ro14=126(7) 02Lo13=126(16) 95Mo26=190(11)														**
*^{65}As^i	J : IAS studied in 93Ba12 and 11Ro47														**
*^{65}Se	T : other 11Ro47=33(4)														**
*^{65}Se	D : %β^+p symmetrized from 11Ro47=88(+12-13)														**
^{66}V	−6300#	500#				10#	ms	>620ns		10	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{66}Cr	−25140#	300#				23.8	ms	1.8	0+	15	11Li50	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{66}Mn	−36750	11				63.8	ms	0.9	(1+)	10	18St18	TDJ	1992	β^-=100;β^-n=7.4 14;β^-2n ?	*
^{66}Mn^m	−36286	11	464.5	0.4		780	μs	40	(5−)		11Li50	ETJ	2005	IT≈100;β^- ?	*
^{66}Fe	−50068	4				467	ms	29	0+	10	18St18	T	1985	β^-=100;β^-n ?	*
^{66}Co	−56409	14				194	ms	17	(1+)	10	12Li02	J	1985	β^-=100;β^-n ?	*
^{66}Co^m	−56234	14	175.1	0.3		824	ns	22	(3+)	10	12Li02	EJ	1998	IT=100	*
^{66}Co^n	−55767	15	642	5		> 100	μs		(8−)	10	98Gr14	E	1998	IT=100	
^{66}Ni	−66006.3	1.4				54.6	h	0.3	0+	10			1948	β^-=100	
^{66}Cu	−66258.3	0.6				5.120	m	0.014	1+*	10	20De21	J	1937	β^-=100	*
^{66}Cu^m	−65104.1	1.5	1154.2	1.4		600	ns	17	(6)−	10	11Lo01	T	1972	IT=100	*
^{66}Zn	−68899.2	0.7				STABLE			0+	10			1922	IS=27.73 98	
^{66}Ga	−63723.7	1.1				9.304	h	0.008	0+*	10	10Se16	T	1937	β^+=100	*
^{66}Ga^i	−59874	6	3850	6	RQ				0+ T=3						
^{66}Ge	−61607.0	2.4				2.26	h	0.05	0+	10			1950	β^+=100	
^{66}As	−52025	6				95.77	ms	0.23	0+ T=1	10	MMC156	J	1978	β^+=100	*
^{66}As^m	−50668	6	1356.63	0.17		1.14	μs	0.04	5+	10	13Ru10	TJ	1995	IT=100	*
^{66}As^n	−49001	6	3023.8	0.3		7.98	μs	0.26	9+	10	13Ru10	TJ	1998	IT=100	*
^{66}Se	−41660#	200#				54	ms	4	0+	10	14Ro14	T	1993	β^+=100;β^+p ?	
^{66}Br	−23570#	400#						<410ns	0+#		16Bl05	I		p ?	
*^{66}Cr	T : average 11Li50=24(2) 11Da08=23(4); other 05Ga01=10(6), outweighed														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{66}Mn	J : 11Li50=(1+) due to large ground-state feeding from ^{66}Cr (J=0+);														**
*^{66}Mn	J : large direct β^- feeding to ^{66}Fe gs (J=0+) in 18St18														**
*^{66}Mn	T : avgerage 18St18=64.1(1.1) 17Ol08=70(15) 13Li04=60(3) 03So21=64(2)														**
*^{66}Mn	T : 99Ha05=66(4); other 11Pa.A=64.2(0.8) is superseded by 18St18														**
*^{66}Mn	D : %β^-n symmetrized from 18St18=7.3(+1.4-1.3)														**
*^{66}Mn^{m}	T : other 05Ga.B=750(250)														**
*^{66}Fe	T : average 18St18=485(+39-34) 99Le67=440(60) 98Am04=440(60)														**
*^{66}Co	J : also large direct β^- feeding to ^{66}Ni gs (J=0+) in 18St18														**
*^{66}Co^{m}	T : symmetrized 18St18=823(+22-21)														**
*^{66}Cu	J : 20De21,10Vi07=1														**
*^{66}Cu^{m}	T : average 11Lo01=601(30) 72Bl16=600(20)														**
*^{66}Ga	T : other 12Gy01=9.312(0.032) not used; Ensdf2010=9.49(0.03)														**
*^{66}As	T : average 88Bu12=95.77(0.28) 78Al23=95.78(0.39); other (recent)														**
*^{66}As	T : 14Ro14=93(4) 02Lo13=97(2) (outweighed)														**
*^{66}As	J : super-allowed β^+-decay emitter; see also 98Gr12														**
*^{66}As^{m}	T : average 13Ru10=1.15(0.04) 01Gr07=1.1(0.1)														**
*^{66}As^{n}	T : average 13Ru10=7.9(0.3) 01Gr07=8.2(0.5)														**
^{67}V	−1740#	600#				8#	ms	>620ns	5/2$^-$#	13	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{67}Cr	−19270#	400#				11#	ms	>300ns	1/2$^-$#	05	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{67}Mn	−33580#	200#				46.7	ms	2.3	5/2$^-$#	05	11Da08	TD	1997	β^-=100;β^-n=10 5;β^-2n ?	*
^{67}Fe	−45708	4				394	ms	9	(1/2$^-$)	05	02So.A	TD	1985	β^-=100;β^-n ?	*
^{67}Fe^{m}	−45305	10	403	9		64	μs	17	(5/2$^+$,7/2$^+$)	05	11Da08	EJ	1998	IT=100	*
^{67}Fe^{n}	−45260#	100#	450#	100#		75	μs	21	(9/2$^+$)		08Bl05	TJ	2008	IT=100	
^{67}Co	−55322	6				329	ms	28	(7/2$^-$)	05	08Pa33	TJ	1985	β^-=100;β^-n ?	
^{67}Co^{m}	−54830	6	491.55	0.11		496	ms	33	(1/2$^-$)		09Pa16	E	2008	IT>80;β^- ?	*
^{67}Ni	−63742.7	2.9				21	s	1	1/2$^-$	05	00Ri14	J	1978	β^-=100	
^{67}Ni^{m}	−62736.1	2.9	1006.6	0.2		13.34	μs	0.19	9/2$^+$	05	14Di08	ETJ	1998	IT=100	*
^{67}Cu	−67319.6	0.9				61.83	h	0.12	3/2$^-$*	05	20De21	J	1948	β^-=100	*
^{67}Zn	−67880.4	0.8				STABLE			5/2$^-$*	05			1928	IS=4.04 16	*
^{67}Zn^{m}	−67787.1	0.8	93.312	0.005		9.15	μs	0.07	1/2$^-$	05	15Ch57	T	1953	IT=100	*
^{67}Zn^{n}	−67275.9	0.8	604.48	0.05		333	ns	14	9/2$^+$	05			1973	IT=100	
^{67}Ga	−66879.2	1.2				3.2617	d	0.0004	3/2$^-$*	05	FGK204	T	1938	ε=100	*
^{67}Ge	−62674	4				18.9	m	0.3	1/2$^-$	05			1950	β^+=100	
^{67}Ge^{m}	−62656	4	18.20	0.05		13.7	μs	0.9	5/2$^-$	05			1978	IT=100	
^{67}Ge^{n}	−61922	4	751.70	0.06		109.1	ns	3.8	9/2$^+$	05	00Ch07	T	1973	IT=100	*
^{67}As	−56587.2	0.4				42.5	s	1.2	(5/2$^-$)	05			1980	β^+=100	
^{67}Se	−46580	70				133	ms	4	5/2$^-$#	05	14Ro14	T	1991	β^+=100;β^+p=0.5 1	*
^{67}Br	−32530#	300#							1/2$^-$#					p ?	
^{67}Kr	−15550#	420#				7.4	ms	2.9	3/2$^-$#		20Gi02	TD	2016	2p=37 14;β^+ ?	*
*^{67}Mn	T : average 11Da08=51(4) 03So21=47(4) 99Ha05=42(4)														**
*^{67}Fe	T : others (recent) 11Da08=304(81) 08Pa33=416(29), outweighed (not used)														**
*^{67}Fe^{m}	T : average 03Sa02=75(21) 98Gr14=43(30), same authors, different experiment														**
*^{67}Fe^{m}	E : less than 30 keV above 387.7-keV level														**
*^{67}Co^{m}	D : %IT from 08Pa33														**
*^{67}Ni^{m}	T : average 14Di08=13.7(0.6) 98Gr14=13.3(0.2); other 02Ge16=13(1)														**
*^{67}Cu	J : 20De21,10Vi07=3/2														**
*^{67}Zn	J : also 17Wr01,16Ya02=5/2														**
*^{67}Zn^{m}	T : average 15Ch57=9.37(0.04) 98At04=9.34(0.20) 96Hw03=9.01(0.03)														**
*^{67}Zn^{m}	T : 75Ro25=9.1(0.4) 73Le18=9.20(0.07) 72Le37=9.15(0.05);														**
*^{67}Zn^{m}	T : Birge ratio=3.27														**
*^{67}Ga	J : other 17Fa09=3/2														**
*^{67}Ge^{n}	T : average 00Ch07=101(3) 79Al04=110.9(1.4); Birge ratio=2.99														**
*^{67}Se	D : %β^+p from 95Bl23														**
*^{67}Kr	T : other 16Go26=7.4(3.0) (same as 20Gi02)														**
^{68}Cr	−15690#	500#				10#	ms	>620ns	0$^+$	12	09Ta24	I	2009	β^- ?;β^-n ?;β^-2n ?	
^{68}Mn	−28920#	300#				33.7	ms	1.5	(3)	12	15Be32	TD	1995	β^-=100;β^-n=18 10;β^-2n ?	*
^{68}Fe	−43900#	190#				188	ms	4	0$^+$	12			1985	β^-=100;β^-n>0	
^{68}Co	−51643	4			*	200	ms	20	(7$^-$)	12			1985	β^-=100;β^-n ?	
^{68}Co^{m}	−51490#	150#	150#	150#	*	1.6	s	0.3	(2$^-$)	12	15Fl01	JD	1998	β^-=100;β^-n>2.6	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{68}Co^{n}	−51450#	150#	195#	150#		101	ns	10	(1)	12	10Da06	T	2010	IT=100	*
^{68}Ni	−63463.8	3.0				29	s	2	0^+	12			1977	β^-=100	
^{68}Ni^{m}	−61860	3	1603.51	0.28		270	ns	5	0^+	12	15Fl01	E	1984	IT=100	*
^{68}Ni^{n}	−60615	3	2849.1	0.3		850	μs	30	5^-	12	15Wi02	T	1995	IT=100	*
^{68}Cu	−65567.0	1.6				30.9	s	0.6	1^+*	12	20De21	J	1953	β^-=100	*
^{68}Cu^{m}	−64845.7	1.6	721.26	0.08		3.75	m	0.05	6^-*	12	20De21	J	1969	IT=86 2;β^-=14 2	*
^{68}Zn	−70007.2	0.8				STABLE			0^+	12			1922	IS=18.45 63	
^{68}Ga	−67086.1	1.4				67.842	m	0.016	1^+*	12	FGK204	T	1937	β^+=100	
^{68}Ge	−66978.8	1.9				271.05	d	0.08	0^+	12	18Be03	T	1948	ε=100	*
^{68}As	−58894.5	1.8				151.6	s	0.8	3^+	12			1971	β^+=100	
^{68}As^{m}	−58469.4	1.8	425.1	0.2		111	ns	20	1^+	12			1994	IT=100	*
^{68}Se	−54189.4	0.5				35.5	s	0.7	0^+	12			1990	β^+=100	
^{68}Br	−38790#	260#						~40ns	3^+#	12	19Wi08	T	1995	p ?	
^{68}Kr	−25630#	500#				21.6	ms	3.3	0^+		20Gi02	TD	2016	β^+= ?;β^+p=90 11;p ?	*

*^{68}Mn T : average 15Be32=38.3(3.6) and 35.2(2.0) 11Da08=29(4) 03So21=28(8) **
*^{68}Mn T : 99Ha05=28(4). **
*^{68}Mn D : β^-n observed by 99Ha05, but not quantified **
*^{68}Mn J : direct β^- feeding to 2+ and 4+ in 15Be32 (incomplete decay scheme) **
*^{68}Co^{n} J : strong feeding in 68Fe (J=0+) β^- decay and possible gamma-ray decay **
*^{68}Co^{n} J : to 2- in 12Li02 **
*^{68}Ni^{m} E : average 15Fl01=1603.6(0.8) 13Re18=1603.5(0.3) from g-ray differences **
*^{68}Ni^{n} T : average 15Wi02=840(40) 95Br10=860(50) **
*^{68}Cu J : 20De21,10Vi07=1 **
*^{68}Cu^{m} J : 20De21,10Vi07=6 **
*^{68}Ge T : average 18Be03=271.14(0.15,NaI), 271.07(0.12,IC) 94Sc44=270.99(0.19) **
*^{68}Ge T : 81Wa26=270.82(0.27) **
*^{68}As^{m} T : symmetrized from 94Ba50=107(+23-16) **
*^{68}Kr D : %β^+p symmetrized from 20Gi02=89(+11-10) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{69}Cr	−9630#	500#				6#	ms	>620ns	$7/2^+$#	14	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{69}Mn	−25360#	400#				22.1	ms	1.6	$5/2^-$#	14	15Be32	TD	1995	β^-=100;β^-n=40 20;β^-2n ?	*
^{69}Fe	−39200#	200#				162	ms	7	$1/2^-$#	14	15Li33	T	1992	β^-=100;β^-n ?;β^-2n ?	
^{69}Co	−50390	90			*	180	ms	20	$(7/2^-)$	14	15Li33	T	1985	β^-=100;β^-n ?	
^{69}Co^{m}	−50213	13	170	90	MD*	750	ms	250	$1/2^-$#		15Li33	TD	2015	β^-=100	
^{69}Ni	−59979	4				11.4	s	0.3	$(9/2^+)$	14			1984	β^-=100	
^{69}Ni^{m}	−59658	4	321	2		3.5	s	0.4	$(1/2^-)$	14	98Gr14	E	1998	$\beta^-\approx$100;IT<0.01	*
^{69}Ni^{n}	−57279	4	2700.0	1.0		439	ns	3	$(17/2^-)$	14			1998	IT=100	
^{69}Cu	−65736.2	1.4				2.85	m	0.15	$3/2^-$*	14	20De21	J	1966	β^-=100	*
^{69}Cu^{m}	−62994.2	1.6	2742.0	0.7		357	ns	2	$(13/2^+)$	14	16Ku11	T	1997	IT=100	*
^{69}Zn	−68417.9	0.8				56.4	m	0.9	$1/2^-$*	14	17Wr01	J	1937	β^-=100	
^{69}Zn^{m}	−67979.3	0.8	438.636	0.018		13.747	h	0.011	$9/2^+$*	14	17Wr01	J	1970	IT=99.967 3;β^-=0.033 3	*
^{69}Ga	−69327.8	1.2				STABLE			$3/2^-$*	14			1923	IS=60.108 50	*
^{69}Ge	−67100.7	1.3				39.05	h	0.10	$5/2^-$*	14			1938	β^+=100	
^{69}Ge^{m}	−67013.9	1.3	86.76	0.02		5.1	μs	0.2	$1/2^-$	14			1978	IT=100	
^{69}Ge^{n}	−66702.8	1.3	397.94	0.02		2.81	μs	0.05	$9/2^+$	14			1978	IT=100	
^{69}As	−63110	30				15.2	m	0.2	$5/2^-$*	14			1955	β^+=100	
^{69}Se	−56434.7	1.5				27.4	s	0.2	$1/2^-$	14			1974	β^+=100;β^+p=0.052 8	
^{69}Se^{m}	−56395.9	1.5	38.85	0.22		2.0	μs	0.2	$5/2^-$	14			1988	IT=100	
^{69}Se^{n}	−55860.7	1.6	574.0	0.4		955	ns	16	$9/2^+$	14	00Ch07	T	1988	IT=100	*
^{69}Br	−46260	40			*	< 24	ns		$(5/2^-)$	15			1988	p=100	
^{69}Br^{m}	−46220#	110#	40#	100#	*				$5/2^-$#		Mirror	I			
^{69}Br^{n}	−45690#	110#	570#	100#					$9/2^+$#		Mirror	I			
^{69}Br^{i}	−42771	19	3490	50	p				$(5/2^-)$ T=3/2	14	11Ro47	I	2011	p=100	
^{69}Kr	−32140#	300#				27.9	ms	0.8	$(5/2^-)$	15	02Gi02	DT	1995	β^+=100;β^+p=94 5	*

*^{69}Mn T : average 15Be32=24.1(2.6) 25.8(2.8) 11Da08=18(4) 99Ha05=14(4) **
*^{69}Ni^{m} E : from 98Gr14; E(9/2+) in ^{73}Ge=-67 keV and ^{71}Zn=156 keV **
*^{69}Ni^{m} E : isotones exhibits a large variation **
*^{69}Cu J : 20De21,10Vi07=3/2 **
*^{69}Cu^{m} T : average 16Ku11=351(14) 12Di03=360(20) 02Ge16=357(2) **
*^{69}Cu^{m} T : 98Gr14=360(50) 97Is13=360(30) **
*^{69}Zn^{m} T : average 17Kr01=13.742(0.014) 77He20=13.756(0.018) **
*^{69}Ga J : other 17Fa09=3/2 **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{69}Se^n	T : average 00Ch07=950(21) 95Po01=960(23)													**
*^{69}Kr	T : average 20Gi02=27.8(1.6) 14De41=28(1) 11Ro47=27(3); other 97Xu01=32(10)													**
*^{69}Kr	D : %β^+p average 02Gi02=93(+7-6) 11Ro47=99(+1-11); other													**
*^{69}Kr	D : 14De41=52.5(6.5) + 2.4(0.5), conflicting													**
^{70}Cr	−5640#	600#				6# ms	>620ns	0^+	16	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{70}Mn	−20450#	500#				19.9 ms	1.7	(4,5)	16	15Be32	TD	2009	β^-=100;β^-n ?;β^-2n ?	
^{70}Fe	−36890#	300#				61.4 ms	0.7	0^+	16	17Mo02	T	1997	β^-=100;β^-n ?	*
^{70}Co	−46525	11			*&	508 ms	7	(1^+)	16	17Mo02	JT	1998	β^-=100;β^-n ?;β^-2n ?	*
^{70}Co^m	−46330#	200#	200#	200#	*&	112 ms	7	(7^-)	16	FGK205	J	1985	β^-=100;IT ?;β^-n ?;β^-2n ?	
^{70}Ni	−59213.9	2.1				6.0 s	0.3	0^+	16			1987	β^-=100	
^{70}Ni^m	−56353.0	2.1	2860.91	0.08		232 ns	1	8^+	16			1997	IT=100	
^{70}Cu	−62976.4	1.1				44.5 s	0.2	6^-*	16	20De21	J	1971	β^-=100	*
^{70}Cu^m	−62875.3	1.1	101.1	0.3		33 s	2	3^-*	16	20De21	J	2002	β^-=52 9;IT=48 9	
^{70}Cu^n	−62733.8	1.2	242.6	0.5		6.6 s	0.2	1^+*	16	20De21	J	1971	β^-=93.2 9;IT=6.8 9	
^{70}Zn	−69564.7	1.9				STABLE	>3.8Ey	0^+	16			1922	IS=0.61 10;2β^- ?	*
^{70}Ga	−68910.2	1.2				21.14 m	0.05	1^+*	16			1937	β^-=99.59 5;ε=0.41 5	*
^{70}Ge	−70562.0	0.8				STABLE		0^+	16			1923	IS=20.52 19	
^{70}As	−64334.0	1.4				52.6 m	0.3	4^+*	16	76He24	J	1950	β^+=100	
^{70}As^m	−64302.0	1.4	32.046	0.023		96 μs	3	2^+	16			1979	IT=100	
^{70}Se	−61929.9	1.6				41.1 m	0.3	0^+	16			1950	β^+=100	
^{70}Br	−51426	15				78.8 ms	0.3	0^+ T=1	16	17Mo18	T	1978	β^+=100;β^+p ?	*
^{70}Br^m	−49134	15	2292.3	0.8		2.16 s	0.05	9^+ T=0	16	17Mo18	T	1981	β^+=100;β^+p ?	*
^{70}Kr	−41100#	200#				45.00 ms	0.14	0^+	16	20Vi02	T	1995	β^+=100;β^+p<1.3	*
*^{70}Fe	T : others (not used): 14XuZZ=66(7) 13Ma87=61(5) 11Da08=71(10) 03So21=94(17)													**
*^{70}Co	T : others (not used) 15Pr10=470(50) 00Mu10=500(180)													**
*^{70}Cu	J : 20De21,10Vi07,16Bi08=6													**
*^{70}Zn	T : 2ν-$\beta\beta$>3.8 Ey 0nu-BB>32 Ey in 11Be39; 0nu-BB>6.8 Ey in 16Eb03													**
*^{70}Ga	J : also 12Pr11=1													**
*^{70}Br	T : average 17Mo18=78.42(0.51) 88Bu12=78.54(0.59) 78Al23=80.2(0.8);													**
*^{70}Br	T : other (recent) 19Si33=79.7(2.4) (outweighed)													**
*^{70}Br^m	T : symmetrized from 17Mo18=2.157(+0.053-0.049); others (not used):													**
*^{70}Br^m	T : 81Vo04=2.2(0.2) 02Ro25=2.2(0.3) (outweighed)													**
*^{70}Kr	T : average 20Vi02=44.99(0.14,stat)(0.06,syst) 45.16(0.68,stat)(0.20,syst);													**
*^{70}Kr	T : others (outweighed) 16De29=31(+13-7) 14Ro14=40(6) 02Bl17=42(31)													**
*^{70}Kr	T : 00Oi02=57(21)													**
^{71}Mn	−16620#	500#				16# ms	>400ns	$5/2^-$#	10	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{71}Fe	−31930#	400#				34.3 ms	2.6	$7/2^+$#	10	13Ma87	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{71}Co	−44370	470				80 ms	3	$(7/2^-)$	10	12Ra10	TJD	1992	β^-=100;β^-n=3 1	*
^{71}Ni	−55406.2	2.2				2.56 s	0.03	$(9/2^+)$	10			1987	β^-=100	
^{71}Ni^m	−55406.0	2.3	499	5		2.3 s	0.3	$(1/2^-)$	10			2009	β^-=100	
^{71}Cu	−62711.1	1.5				19.4 s	1.4	$3/2^-$*	10			1983	β^-=100	*
^{71}Cu^m	−59955.4	1.6	2755.7	0.6		271 ns	13	$(19/2^-)$	10	98Gr14	TJ	1998	IT=100	*
^{71}Zn	−67328.8	2.7				2.40 m	0.05	$1/2^-$*	10	17Wr01	J	1955	β^-=100	*
^{71}Zn^m	−67171.1	2.4	157.7	1.3	MD	4.148 h	0.012	$9/2^+$*	10			1958	$\beta^-\approx$100;IT ?	*
^{71}Ga	−70139.1	0.8				STABLE		$3/2^-$*	10			1923	IS=39.892 50	*
^{71}Ge	−69906.7	0.8				11.43 d	0.03	$1/2^-$*	10			1941	ε=100	
^{71}Ge^m	−69708.3	0.8	198.354	0.014		20.41 ms	0.18	$9/2^+$	10			1959	IT=100	
^{71}As	−67893	4				65.30 h	0.07	$5/2^-$*	10			1939	β^+=100	
^{71}Se	−63146.5	2.8				4.74 m	0.05	$(5/2^-)$	10			1957	β^+=100	
^{71}Se^m	−63097.7	2.8	48.79	0.05		5.6 μs	0.7	$(1/2^-)$	10			1982	IT=100	
^{71}Se^n	−62886.0	2.8	260.48	0.10		19.0 μs	0.5	$(9/2^+)$	10			1982	IT=100	
^{71}Br	−56502	5				21.4 s	0.6	$(5/2)^-$	10			1981	β^+=100	
^{71}Kr	−46330	130				98.8 ms	0.3	$(5/2)^-$	10	19Si33	T	1981	β^+=100;β^+p=2.1 7	*
^{71}Rb	−32290#	400#			*			$5/2^-$#					p ?	
^{71}Rb^m	−32240#	410#	50#	100#	*			$1/2^-$#		Mirror	I			
^{71}Rb^n	−32030#	410#	260#	100#				$9/2^+$#		Mirror	I			
*^{71}Fe	T : average 14XuZZ=34.7(3.6) 13Ma87=42(6) 11Da08=28(5)													**
*^{71}Co	D : %β^-n from 12Ra10<2.7(0.9) and 05Ma95>3(1) of the same group													**
*^{71}Co	T : others 19Ly02=86(10) 12Ra10=10RaZY=80(3) 04Sa59=79(5) 03So21=97(2)													**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{71}Co T : 98Am04=210(40) 95Am.A=200(50) **
*^{71}Cu T : average 99Pr10=19(3) 83Ru06=19.5(1.6) **
*^{71}Cu J : 20De21,10Vi07=3/2 **
*^{71}Cu^m T : average 98Is11=250(30) 98Gr14=275(14) **
*^{71}Zn T : average 17Kr01=2.36(0.08) 61Th04=2.45(0.10) **
*^{71}Zn^m J : 17Wr01=9/2 **
*^{71}Zn^m T : average 17Kr01=4.155(0.004) 12Re05=4.127(0.007); Birge ratio=3.47 **
*^{71}Zn^m D : 156 keV depopulating transition not observed experimentally and **
*^{71}Zn^m D : only a limit of %IT<0.05 given in 70Zo01 **
*^{71}Ga J : other 17Fa09=3/2 **
*^{71}Kr T : others 14Ro14=92(9) 97Oi01=100(3) 81Ew01=97(9) 95Bl23=64(+8-5). **
*^{71}Kr T : Values from 95Bl23 for ^{67}Se and ^{71}Kr questioned in 97Oi01 **
*^{71}Kr D : %β^+p from 97Oi01=2.1 7; other 95Bl23=5.2(0.6) conflicting not trusted **

^{72}Mn	−11170#	600#				12# ms >620ns		13	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{72}Fe	−29250#	500#				17.0 ms 1.0	0^+	10	13Ma87	TD	1997	β^-=100;β^-n ?;β^-2n ?	*
^{72}Co	−40300#	300#			*	52.5 ms 0.3	$(6^-,7^-)$	10	16Mo07	T	1992	β^-=100;β^-n>4;β^-2n ?	*
^{72}Co^m	−40100#	360#	200#	200#	*	47.8 ms 0.5	$(0^+,1^+)$		16Mo07	TJ	2016	β^-=100	
^{72}Ni	−54226.1	2.2				1.57 s 0.05	0^+	10			1987	β^-=100;β^-n ?	
^{72}Cu	−59783.0	1.4				6.63 s 0.03	2^-*	10	20De21	J	1983	β^-=100	*
^{72}Cu^m	−59512.7	1.7	270.3	1.0		1.76 μs 0.03	(6^-)	10			1998	IT=100	*
^{72}Zn	−68145.5	2.1				46.5 h 0.1	0^+	10			1951	β^-=100	
^{72}Ga	−68588.3	0.8				14.025 h 0.010	3^-*	10	12Kr07	T	1939	β^-=100	
^{72}Ga^m	−68468.6	0.8	119.66	0.05		39.68 ms 0.13	(0^+)	10			1968	IT=100	
^{72}Ge	−72585.91	0.08				STABLE	0^+	10			1923	IS=27.45 15	
^{72}Ge^m	−71894.48	0.09	691.43	0.04		444.2 ns 0.8	0^+	10			1984	IT=100	
^{72}As	−68230	4				26.0 h 0.1	2^-*	10			1939	β^+=100	
^{72}Se	−67868.2	2.0				8.40 d 0.08	0^+	10			1948	ε=100	
^{72}Br	−59061.8	1.0				78.6 s 2.4	1^+	10			1970	β^+=100	
^{72}Br^m	−58961.0	1.0	100.76	0.15		10.6 s 0.3	(3^-)	10			1980	IT≈100;β^+ ?	
^{72}Kr	−53941	8				17.16 s 0.18	0^+	10	03Pi03	T	1973	β^+=100	*
^{72}Rb	−38330#	500#			*	103 ns 22	1^+#		17Su31	T	2017	p ?	*
^{72}Rb^m	−38230#	510#	100#	100#	*		3^-#					p ?	

*^{72}Fe T : average 14XuZZ=16.9(1.0) 13Ma87=19(4) **
*^{72}Co T : others 14Xu07=52.8(1.6) 14Ra20=55(4) 05Ma59=59(2) 03Sa40=62(3) **
*^{72}Co J : β^- feeding of the 6+ level in ^{72}Ni and shell model **
*^{72}Co D : from %β^-n>6(2) in 05Ma95 **
*^{72}Cu J : 20De21,10Vi07=2 **
*^{72}Cu^m D : no β^-decay observed in 05Th.A **
*^{72}Kr T : average 03Pi03=17.1(0.2) 73Da22=17.4(0.4) **
*^{72}Rb J : 19Si33=p3/2[321] n1/2[321], K=1+; similarity with the mirror ^{72}Br **

^{73}Mn	−6700#	600#				12# ms >410ns	$5/2^-$#	19	17Su15	I	2017	β^- ?	
^{73}Fe	−23990#	500#				12.9 ms 1.6	$7/2^+$#	19	14XuZZ	T	2010	β^-=100;β^-n ?;β^-2n ?	
^{73}Co	−37970#	300#				42.0 ms 0.8	$(7/2^-)$	19	20Go10	JTD	1995	β^-=100;β^-n=6 3;β^-2n ?	*
^{73}Ni	−50108.2	2.4				840 ms 30	$(9/2^+)$	19			1987	β^-=100;β^-n ?	
^{73}Cu	−58987.4	1.9				4.20 s 0.12	$3/2^-$*	19	00KoZH	TD	1983	β^-=100;β^-n=0.029 6	*
^{73}Zn	−65593.4	1.9				24.5 s 0.2	$1/2^-$*	19	17Ve05	T	1972	β^-=100	*
^{73}Zn^m	−65397.9	1.9	195.5	0.2		13.0 ms 0.2	$5/2^+$*	19	18Ya11	J	1985	IT=100	
^{73}Ga	−69699.3	1.7				4.86 h 0.03	$1/2^-$*	19	10Ch16	J	1949	β^-=100	
^{73}Ga^m	−69699.2	1.7	0.15	0.09		< 200 ms	$3/2^-$	19	17Ve05	E	1949	β^- ?; IT ?	*
^{73}Ge	−71297.53	0.06				STABLE	$9/2^+$*	19	49To09	J	1933	IS=7.76 8	
^{73}Ge^m	−71284.25	0.06	13.2845	0.0015		2.91 μs 0.03	$5/2^+$	19			1975	IT=100	
^{73}Ge^n	−71230.80	0.06	66.725	0.009		499 ms 11	$1/2^-$	19			1957	IT=100	
^{73}As	−70953	4				80.30 d 0.06	$3/2^-$	19			1948	ε=100	
^{73}As^m	−70525	4	427.902	0.021		5.7 μs 0.2	$9/2^+$	19			1956	IT=100	
^{73}Se	−68227	7				7.15 h 0.09	$9/2^+$*	19	88Be39	J	1948	β^+=100	
^{73}Se^m	−68201	7	25.71	0.04		39.8 m 1.7	$3/2^-$	19			1960	IT=72.6 3;β^+=27.4 3	
^{73}Br	−63646	7				3.4 m 0.2	$1/2^-$	19			1970	β^+=100	
^{73}Kr	−56552	7				27.3 s 1.0	$(3/2)^-$	19			1972	β^+=100;β^+p=0.25 3	
^{73}Kr^m	−56118	7	433.55	0.13		107 ns 10	$(9/2^+)$	19			1993	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{73}Kr^{i}	−53350#	120#	3204#	118#					T=3/2		20Ho17	E			
^{73}Rb	−46010	40				< 81	ns		$3/2^-$#	19	17Su31	T	1996	β^+ ?; p≈100	
^{73}Rb^{m}	−45580#	110#	430#	100#					$9/2^+$#		Mirror	I			
^{73}Rb^{i}	−42809	20	3200	40	p				$(5/2^-)$ T=5/2	19	20Ho06	JD	1993	p=100	*
^{73}Sr	−31950#	400#				25.3	ms	1.4	$(5/2^-)$	19	20Ho06	TDJ	1993	β^+=100;β^+p=63 3	*

*^{73}Co D : %β^-n from 20Go10=6(3), supersedes 12Ra10<22(8) 05Ma95>9(4); other **
*^{73}Co D : 10Ho12<7.9 **
*^{73}Co T : average 20Go10=43(1), supersedes 12Ra10=42(3), 14Xu07=40.4(1.3), **
*^{73}Co T : supersedes 14Xu.A=40.5(3.3), 11Da08,04Sa59=41(4) 10Ho12=41(6) **
*^{73}Cu T : average 00KhZH=4.22(0.15) 98Hu20=4.4(0.3) 83Ru06=3.9(0.3) **
*^{73}Cu J : 20De21,17De30,10Vi07,09Fl03=3/2 **
*^{73}Zn J : 17Wr01,18Ya11=1/2 **
*^{73}Ga^{m} E : from <0.3 keV in 17Ve05 **
*^{73}Rb^{i} J : other 93Ba61=1/2-, T=3/2 **
*^{73}Rb^{i} E : from 20Ho17 **
*^{73}Sr T : average 20Ho06=23.1(1.4) 19Si33=28(+5-4); others: 20Ho06=23.5(1.8) **
*^{73}Sr T : 19Si33=24.3(5.3) using a least-squares fit analysis **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{74}Fe	−20660#	500#				5	ms	5	0^+	17	10Oh02	I	2010	β^-=100;β^-n ?;β^-2n ?	*
^{74}Co	−33540#	400#				31.3	ms	1.3	7^-#	06	10Ho12	TD	1995	β^-=100;β^-n=18 15;β^-2n ?	*
^{74}Ni	−48700#	200#				507.7	ms	4.6	0^+	06	14Xu07	T	1987	β^-=100;β^-n ?	
^{74}Cu	−56006	6				1.606	s	0.009	2^-*	06	00KoZH	TD	1987	β^-=100;β^-n=0.075 16	*
^{74}Zn	−65756.7	2.5				95.6	s	1.2	0^+	06			1972	β^-=100	
^{74}Ga	−68049.6	3.0				8.12	m	0.12	(3^-)*	06	13Ma15	J	1956	β^-=100	
^{74}Ga^{m}	−67990	3	59.571	0.014		9.5	s	1.0	$(0)(^+$#)	06			1974	IT=75 25;β^- ?	
^{74}Ge	−73422.451	0.013				STABLE			0^+	06			1923	IS=36.52 12	
^{74}As	−70860.1	1.7				17.77	d	0.02	2^-	06			1938	β^+=66 2;β^-=34 2	
^{74}Se	−72213.210	0.015				STABLE		>2.3Ey	0^+	06	20Ba08	T	1922	IS=0.86 3;2β^+ ?	
^{74}Br	−65288	6				25.4	m	0.3	(0^-)	06			1952	β^+=100	
^{74}Br^{m}	−65274	6	13.58	0.21		46	m	2	4^+*	06			1953	β^+=100	
^{74}Kr	−62331.8	2.0				11.50	m	0.11	0^+	06			1960	β^+=100	
^{74}Rb	−51916	3				64.78	ms	0.03	0^+* T=1	06	11Ma66	J	1977	β^+=100;β^+p ?	*
^{74}Sr	−40830#	100#				27.6	ms	2.6	0^+	15	19Si33	T	1995	β^+=100;β^+p ?	*

*^{74}Fe T : symmetrized from 14XuZZ=8.2(+2.6-7.1) **
*^{74}Co T : average 14Xu07=31.6(1.5) 05Ma95=30(3) **
*^{74}Co T : others (recent) 11Da08=19(7) 10Ho12=34(+6-9) outweighed (not used) **
*^{74}Cu T : average 05Va19=1.75(0.06) 00KoZH=1.68(0.03) 91Kr15=1.594(0.010) **
*^{74}Cu T : 89Wi11=1.59(0.05); others 90Be13=1.51(0.27) **
*^{74}Cu J : 20De21,17De30,10Vi07,10Fi02=2 **
*^{74}Rb T : average 01Ba12=64.761(0.031) 02Oi02,01Oi04=64.90(0.09); other (recent) **
*^{74}Rb T : 19Si33=65.1(0.5) (outweighed) **
*^{74}Sr T : average 19Si33=27.7(2.8) 14He29=27(8) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{75}Fe	−14700#	600#				9#	ms	>620ns	$9/2^+$#	13	13Ta14	I	2013	β^- ?;β^-n ?;β^-2n ?	
^{75}Co	−30560#	400#				26.5	ms	1.2	$7/2^-$#	13	14Xu07	T	1995	β^-=100;β^-n<16;β^-2n ?	*
^{75}Ni	−44240#	200#				331.6	ms	3.2	$9/2^+$#	13	14Xu07	T	1992	β^-=100;β^-n=10.0 28	
^{75}Cu	−54470.2	0.7				1.224	s	0.003	$5/2^-$*	13	00KoZH	D	1985	β^-=100;β^-n=2.7 4	*
^{75}Cu^{m}	−54408.5	0.8	61.7	0.4		310	ns	8	$1/2^-$	13	16Pe14	ET	2010	IT=100	*
^{75}Cu^{n}	−54404.0	0.8	66.2	0.4		149	ns	5	$3/2^-$	13	16Pe14	ET	2010	IT=100	*
^{75}Zn	−62558.9	2.0				10.2	s	0.2	$7/2^+$*	13	17Wr01	J	1974	β^-=100	
^{75}Zn^{m}	−62432.0	2.0	126.94	0.09		5#	s		$1/2^-$*	13	17Wr01	J	2011	β^- ?;IT ?	
^{75}Ga	−68460.6	0.7				126	s	2	$3/2^-$*	13			1960	β^-=100	*
^{75}Ge	−71856.97	0.05				82.78	m	0.04	$1/2^-$*	13			1939	β^-=100	
^{75}Ge^{m}	−71717.28	0.06	139.69	0.03		47.7	s	0.5	$7/2^+$	13			1952	IT≈100;β^-=0.030 6	
^{75}Ge^{n}	−71664.78	0.08	192.19	0.06		216	ns	5	$5/2^+$	13			1982	IT=100	
^{75}As	−73034.2	0.9				STABLE			$3/2^-$*	13			1920	IS=100	
^{75}As^{m}	−72730.3	0.9	303.9243	0.0008		17.62	ms	0.23	$9/2^+$	13			1957	IT=100	
^{75}Se	−72169.49	0.07				119.78	d	0.03	$5/2^+$*	13	FGK209	T	1947	ε=100	
^{75}Br	−69107	4				96.7	m	1.3	$3/2^-$	13			1948	β^+=100	
^{75}Kr	−64324	8				4.60	m	0.07	$5/2^+$*	13	95Ke04	J	1960	β^+=100	
^{75}Rb	−57218.7	1.2				19.0	s	1.2	$3/2^-$*	13			1975	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{75}Sr	−46620	220				85.2	ms	2.3	(3/2$^-$)	13	19Si33	T	1991	β^+=100;β^+p=5.2 9	*
^{75}Y	−31820#	300#				100#	μs		5/2$^+$#					β^+ ?;β^+p ?;p ?	

*^{75}Co D : %β^-n from 11Ho21<16 **
*^{75}Co T : from 14Xu07=26.5(1.2); others 20Go10=27(13) 11Ho21=30(11) **
*^{75}Cu T : average 11Il01=1.222(0.008) 91Kr15=1.224(0.003) 00KoZH=1.225(0.007) **
*^{75}Cu D : %β^-n average 00KoZH=2.2(0.5) 85Re01=3.5(0.6) **
*^{75}Cu J : 20De21,17De30,10Vi07,11Ko36,09Fi03=5/2 **
*^{75}Cu^m J : from 19Ic02 **
*^{75}Cu^n J : from 19Ic02 **
*^{75}Ga J : other 17Fa09=3/2 **
*^{75}Sr T : average 19Si33=81.7(3.4) 03Hu01=88(3). **
*^{75}Sr T : other 01Ki13=71(+71-24) and 80(+400-40) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{76}Fe	−10590#	600#				3#	ms	>410ns	0$^+$		17Su15	I	2017	β^- ?	
^{76}Co	−25660#	500#			*	23	ms	6	(8$^-$)	14	14Xu07	TD	2010	β^-=100;β^-n ?;β^-2n ?	*
^{76}Co^m	−25560#	510#	100#	100#	*	16	ms	4	(1$^-$)		15So23	TJD	2015	β^-=100	
^{76}Co^n	−24920#	510#	740#	100#		2.99	μs	0.27	(3$^+$)		15So23	TJD	2015	IT=100	*
^{76}Ni	−42190#	300#				234.6	ms	2.7	0$^+$	07	14Xu07	T	1995	β^-=100;β^-n=14.0 36	
^{76}Ni^m	−39770#	300#	2418.0	0.5		547.8	ns	3.3	(8$^+$)	07	15So23	TE	2005	IT=100	
^{76}Cu	−50981.6	0.9				637.7	ms	5.5	3$^-$*	95	09Wi03	D	1987	β^-=100;β^-n=7.2 5	*
^{76}Cu^m			*non − exist*		RN	1.27	s	0.30	(1,3)	95	90Wi12	IJT	1990	β^-=100	*
^{76}Zn	−62303.0	1.5				5.7	s	0.3	0$^+$	95			1974	β^-=100	
^{76}Ga	−66296.6	2.0				30.6	s	0.6	2$^-$*	95			1961	β^-=100	*
^{76}Ge	−73212.898	0.018				1.88	Zy	0.08	0$^+$	95	20Ba.A	T	1933	IS=7.75 12;2β^-=100	*
^{76}As	−72291.4	0.9				1.0933	d	0.0038	2$^-$*	95			1934	β^-=100	
^{76}As^m	−72247.0	0.9	44.425	0.001		1.84	μs	0.06	(1)$^+$	95			1966	IT=100	
^{76}Se	−75251.959	0.016				STABLE			0$^+$	95			1922	IS=9.23 7	
^{76}Br	−70289	9				16.2	h	0.2	1$^-$*	95			1952	β^+=100	
^{76}Br^m	−70186	9	102.58	0.03		1.31	s	0.02	(4)$^+$	95			1979	IT≈100;β^+<0.6	
^{76}Kr	−69014	4				14.8	h	0.1	0$^+$	95			1954	β^+=100	
^{76}Rb	−60479.1	0.9				36.5	s	0.6	1$^-$*	95			1969	β^+=100;$\beta^+\alpha$=3.8e-7 10	*
^{76}Rb^m	−60162.2	0.9	316.93	0.08		3.050	μs	0.007	(4$^+$)	95	00Ch07	T	1986	IT=100	
^{76}Sr	−54250	30				7.89	s	0.07	0$^+$	11			1990	β^+=100;β^+p=3.4e-3 8	
^{76}Y	−38250#	300#				28	ms	9	1$^-$#	07	19Si33	TJ	2001	β^+ ?;p ?;β^+p ?	*

*^{76}Co T : symmetrized from 14Xu07=21.7(+6.5-4.9) **
*^{76}Co J : from 15So23 **
*^{76}Co^n E : 15So23=638.4(0.8) above ^{76}Co^m **
*^{76}Co^n T : symmetrized from 15So23=2.96(+0.29-0.25) **
*^{76}Cu T : average 10Ho12=599(18) 05Va19=653(24) 91Kr15=641(6) **
*^{76}Cu J : 20De21,17De30=3 **
*^{76}Cu^m I : reported only in 90Wi12; not confirmed in 05Va19 **
*^{76}Ga T : average 16Do05=30.6(0.3) 85Ta01=32.6(0.6) 74Gr29=29.8(0.4) Birge B=2.7 **
*^{76}Ge T : value for 2ν-$\beta\beta$; other 15Ba11=1.65(+0.14-0.12) (evaluation). **
*^{76}Ge T : 0nu-BB 19Al24>27Yy, 18Aa02>19Yy, 18Ag03>80Yy, **
*^{76}Ge T : 13Ag11>30Yy combined GERDA+HDM+IGEX results; all at (90% C.L.); **
*^{76}Ge T : others 01Kl13=15 Yy 04Kl03=11.2 Yy not trusted. See also **
*^{76}Ge T : 02Aa.A and 02Zd02 **
*^{76}Rb J : also 11Ma66=1 **
*^{76}Y T : symemtrized from 19Si33=24(+12-6) **
*^{76}Y J : 19Si33=p5/2[422] n3/2[312], K=1-; similarity with the mirror ^{76}Br **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{77}Co	−21910#	600#				15	ms	6	7/2$^-$#	20			2014	β^-=100;β^-n ?;β^-2n ?; β^-3n ?	*
^{77}Ni	−37350#	400#				158.9	ms	4.2	9/2$^+$#	20	14Xu07	T	1995	β^-=100;β^-n=26 13;β^-2n ?	*
^{77}Cu	−48862.8	1.2				470.3	ms	1.7	5/2$^-$*	20	20De21	J	1987	β^-=100;β^-n=30.1 13	*
^{77}Zn	−58789.2	2.0				2.08	s	0.05	7/2$^+$*	20	17Wr01	J	1977	β^-=100	
^{77}Zn^m	−58016.8	2.0	772.440	0.015		1.05	s	0.10	1/2$^-$*	20	17Wr01	J	1986	β^-=66 7;IT=34 7	
^{77}Ga	−65992.4	2.4				13.2	s	0.2	3/2$^-$*	20			1968	β^-=100[gs=12,m=88]	
^{77}Ge	−71212.87	0.05				11.211	h	0.003	7/2$^+$	20			1939	β^-=100	
^{77}Ge^m	−71053.16	0.08	159.71	0.06		53.7	s	0.6	1/2$^-$	20			1947	β^-=81 2;IT=19 2	
^{77}As	−73916.3	1.7				38.79	h	0.05	3/2$^-$	20			1951	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$^{77}As^m$	−73440.8	1.7	475.48	0.04		114.0	μs	2.5	9/2$^+$	20			1957	IT=100	
^{77}Se	−74599.50	0.06				STABLE			1/2$^-$*	20			1922	IS=7.60 7	
$^{77}Se^m$	−74437.58	0.06	161.9223	0.0010		17.36	s	0.05	7/2$^+$	20			1947	IT=100	
^{77}Br	−73234.8	2.8				57.04	h	0.12	3/2$^-$*	20			1948	β^+=100	
$^{77}Br^m$	−73128.9	2.8	105.86	0.08		4.28	m	0.10	9/2$^+$*	20			1961	IT=100	
^{77}Kr	−70169.5	2.0				72.6	m	0.9	5/2$^+$*	20	19Ze02	T	1948	β^+=100	*
$^{77}Kr^m$	−70103.0	2.0	66.50	0.05		118	ns	12	3/2$^-$	20			1975	IT=100	
^{77}Rb	−64830.5	1.3				3.78	m	0.04	3/2$^-$*	20			1972	β^+=100	*
^{77}Sr	−57803	8				9.0	s	0.2	5/2$^+$*	20	13Ma15	J	1976	β^+=100;β^+p=0.08 3	
^{77}Y	−46440#	200#				63	ms	17	5/2$^+$#	20	00We.A	D	1999	$\beta^+\approx$100;β^+p ?;p ?	*
^{77}Zr	−31600#	400#				100#	μs		3/2$^-$#	20	17Su31	I	2017	β^+ ?;β^+p ?;p ?	

*^{77}Co T : symmetrized from 14Xu07=13.0(+7.2-4.3) **
*^{77}Ni D : %β^-n average 10Ho12=30(24) 14XuZZ=24(16) **
*^{77}Cu J : 20De21,17De30,11Ko36=5/2 **
*^{77}Cu D : %β^-n average 18Ra27=29.2(3.0) 10Ho12=31.0(3.8) 09Il01=30.3(2.0) **
*^{77}Cu D : 09Wi03=30.0(2.7); other 02Pf04=15(+10-5) **
*^{77}Cu T : average 14XuZZ=476.8(3.4) 09Pa35=467.4(2.1) 09Tl01=480(9) 91Kr15=469(8) **
*^{77}Kr T : average 19Ze02=71.25(42) 73Ba22=75(3) 71Bo30=74.7(0.4) 60Bu22=71.1(0.5) **
*^{77}Kr T : 57Be46=69(6); Birge ratio=3.46 **
*^{77}Kr J : 95Ke04=5/2 **
*^{77}Rb J : also 81Th04=3/2 **
*^{77}Y T : symmetrized from 01Ki13=57(+22-12) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{78}Co	−15320#	700#				11#	ms	>410ns			17Su15	I	2017	β^- ?	
^{78}Ni	−34880#	400#				122.2	ms	5.1	0$^+$	09	14Xu07	T	1995	β^-=100;β^-n ?;β^-2n ?	
^{78}Cu	−44789	13				330.7	ms	2.0	(6$^-$)*	09	14Xu07	T	1991	β^-=100;β^-n=50.6 45; β^-2n ?	*
^{78}Zn	−57483.2	1.9				1.47	s	0.15	0$^+$	09			1977	β^-=100;β^-n ?	
$^{78}Zn^m$	−54809.5	2.0	2673.7	0.6		320	ns	6	(8$^+$)	09	12Ka36	ET	1998	IT=100	*
^{78}Ga	−63704.1	1.1				5.09	s	0.05	2$^-$*	09			1972	β^-=100	
$^{78}Ga^m$	−63205.2	1.2	498.9	0.5		110	ns	3		09	10Da06	ET	2010	IT=100	*
^{78}Ge	−71862	4				88.0	m	1.0	0$^+$	09			1953	β^-=100	
^{78}As	−72817	10				90.7	m	0.2	2$^-$	09			1937	β^-=100	
^{78}Se	−77025.95	0.18				STABLE			0$^+$	09			1922	IS=23.69 22	
^{78}Br	−73452	4				6.45	m	0.04	1$^+$*	09	73Hi01	D	1937	$\beta^+\approx$100;β^-<0.01	
$^{78}Br^m$	−73271	4	180.89	0.13		119.4	μs	1.0	(4$^+$)	09			1958	IT=100	
^{78}Kr	−74178.3	0.3				STABLE		>110Ey	0$^+$	09	94Sa31	T	1920	IS=0.355 3;2β^+ ?	*
^{78}Rb	−66935	3				17.66	m	0.03	0$^+$*	09			1968	β^+=100	*
$^{78}Rb^m$	−66888	3	46.84	0.14		910	ns	40	(1$^-$)	09			1996	IT=100	
$^{78}Rb^n$	−66824	3	111.19	0.22		5.74	m	0.03	4$^-$*	09			1968	β^+=91 2;IT=9 2	*
$^{78}Rb^x$	−66861	12	74	12		$R=2.0$ 0.5			*spmix*						
^{78}Sr	−63174	7				156.1	s	2.7	0$^+$	09	11Pe29	T	1982	β^+=100	*
^{78}Y	−52170#	300#			*	54	ms	5	(0$^+$)	09	01Ga24	TJ	1992	β^+=100;β^+p ?	*
$^{78}Y^m$	−52170#	580#	0#	500#	*	5.8	s	0.6	(5$^+$)	09			1998	β^+=100;β^+p ?	
^{78}Zr	−40850#	400#				50#	ms	>200ns	0$^+$	09	01Ki13	I	2001	β^+ ?;β^+p ?	*

*^{78}Cu D : %β^-n average 10Ho12=44.0(5.4) 09Wi03=65(8) **
*^{78}Cu J :20De21,17De30,11Ko36=(6); other 12Ko29=(5) **
*^{78}Zn^m E : from 12Ko29; other 12Ka36=2675.3(1.0) **
*^{78}Zn^m T : average 12Ka36=320(+9-8) 00Da07=319(9) **
*^{78}Ga^m ET : other E=559.6(0.7) keV, T1/2<500 ns in Ensdf2009 **
*^{78}Kr T : limit given here is for the K-e$^+$ decay (theoretically faster) **
*^{78}Rb J : other 11Ma66,81Th04=0 **
*^{78}Rb^n J : other 11Ma66,81Th04=4 **
*^{78}Sr T : average 11Pe29=155(3) 97Mu02=168(12) 92Gr09=159(8) **
*^{78}Y T : average 01Ga24=50(8) 01Ki13=55(+9-6) **
*^{78}Zr I : other 00We.A>170 ns, same group as 01Ki13 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{79}Ni	−28160#	500#				44	ms	8	5/2$^+$#	16			2010	β^-=100;β^-n ?;β^-2n ?	
^{79}Cu	−42410	100				241.3	ms	2.1	(5/2$^-$)*	16	14Xu07	T	1991	β^-=100;β^-n=66 10;β^-2n ?	*
^{79}Zn	−53432.3	2.2				746	ms	42	9/2$^+$*	16			1981	β^-=100;β^-n=1.7 5	*
$^{79}Zn^m$	−52330	150	1100	150		> 200	ms		1/2$^+$*	16	17Wr01	J	2015	IT ?;β^- ?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{79}Ga	−62548.4	1.2				2.848	s	0.003	$3/2^-$*	16			1974	β^-=100;β^-n=0.089 19	*
^{79}Ge	−69530	40				18.98	s	0.03	$(1/2)^-$	16			1970	β^-=100	
^{79}Ge^m	−69340	40	185.95	0.04		39.0	s	1.0	$7/2^+$#	16			1970	β^-=96 1;IT=4 1	
^{79}As	−73636	5				9.01	m	0.15	$3/2^-$	16			1950	β^-=100	
^{79}As^m	−72863	5	772.81	0.06		1.21	μs	0.01	$(9/2)^+$	16	98Gr14	T	1998	IT=100	
^{79}Se	−75917.47	0.22				327	ky	28	$7/2^+$*	16			1950	β^-=100	
^{79}Se^m	−75821.70	0.22	95.77	0.03		3.900	m	0.018	$1/2^-$	16	88Kl03	D	1950	IT≈100;β^-=0.056 11	*
^{79}Br	−76068.1	1.0				STABLE			$3/2^-$*	16			1920	IS=50.65 9	
^{79}Br^m	−75860.5	1.0	207.61	0.09		4.85	s	0.04	$9/2^+$	16			1954	IT=100	
^{79}Kr	−74442	3				35.04	h	0.10	$1/2^-$*	16	95Ke04	J	1948	β^+=100	
^{79}Kr^m	−74312	3	129.77	0.05		50	s	3	$7/2^+$*	16	95Ke04	J	1940	IT=100	
^{79}Rb	−70802.8	1.9				22.9	m	0.5	$5/2^+$*	16			1957	β^+=100	*
^{79}Sr	−65480	7				2.25	m	0.10	$3/2^-$*	16			1972	β^+=100	*
^{79}Y	−57800	80				14.8	s	0.6	$5/2^+$#	16			1992	β^+=100	
^{79}Zr	−46770#	300#				56	ms	30	$5/2^+$#	16			1999	β^+=100;β^+p ?	
^{79}Nb	−31650#	500#							$9/2^+$#					p ?;β^+ ?;β^+p ?	

*^{79}Cu J : 17De30=(5/2) **
*^{79}Cu T : others 10Ho12=257(+29-26) 91Kr15=188(25) **
*^{79}Cu D : %β^-n average 10Ho12=72(12) 91Kr15=55(17) **
*^{79}Zn J : 17Wr01,16Ya02=9/2 **
*^{79}Zn^m J : 17Wr01,16Ya02=1/2 **
*^{79}Ga J : also 17Fa09=3/2 **
*^{79}Se^m T : average 19De24=3.884(0.009) (quoted in the text in hours is a typo) **
*^{79}Se^m T : 90Ab02=3.92(0.01); Birge ratio=2.68 **
*^{79}Rb J : also 81Th04=5/2 **
*^{79}Sr J : 90Li28=3/2 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{80}Ni	−23240#	600#				30	ms	22	0^+	14			2014	β^-=100;β^-n ?;β^-2n ?	*
^{80}Cu	−36680#	300#				113.3	ms	6.4		14	14Xu07	T	1995	β^-=100;β^-n=58 9;β^-2n ?	*
^{80}Zn	−51648.6	2.6				562.2	ms	3.0	0^+	14	14Xu07	T	1981	β^-=100;β^-n=1.36 12	*
^{80}Ga	−59223.7	2.9			*	1.9	s	0.1	6^-*	14	13Ve03	TJ	1974	β^-=100;β^-n=0.86 7	*
^{80}Ga^m	−59201.3	2.9	22.45	0.10	*	1.3	s	0.2	3^-*	14	13Ve03	TJ	2011	β^-≈100;β^-n ?;IT ?	
^{80}Ge	−69535.3	2.1				29.5	s	0.4	0^+	05			1972	β^-=100	
^{80}As	−72215	3				15.2	s	0.2	1^+	05			1954	β^-=100	
^{80}Se	−77759.5	0.9				STABLE			0^+	05			1922	IS=49.80 36;2β^- ?	
^{80}Br	−75889.0	1.0				17.68	m	0.02	1^+*	05			1937	β^-=91.7 2;β^+=8.3 2	
^{80}Br^m	−75803.2	1.0	85.843	0.004		4.4205	h	0.0008	5^-*	05			1937	IT=100	
^{80}Kr	−77893.5	0.7				STABLE			0^+	05			1920	IS=2.286 10	
^{80}Rb	−72175.5	1.9				33.4	s	0.7	1^+*	05	93Al03	T	1961	β^+=100	*
^{80}Rb^m	−71681.6	2.0	493.9	0.5		1.63	μs	0.04	(6^+)	05	92Do10	E	1980	IT=100	
^{80}Sr	−70311	3				106.3	m	1.5	0^+	05			1961	β^+=100	
^{80}Y	−61148	6				30.1	s	0.5	4^-	05			1981	β^+=100	
^{80}Y^m	−60920	6	228.5	0.1		4.8	s	0.3	1^-	05	01No07	J	1998	IT=81 2;β^+=19 2	*
^{80}Y^n	−60835	6	312.6	0.9		4.7	μs	0.3	(2^+)	05			1997	IT=100	
^{80}Zr	−54760#	300#				4.6	s	0.6	0^+	05	01Ki13	T	1987	β^+=100	*
^{80}Nb	−38420#	400#							4^-#					p ?;β^+ ?;β^+p ?	

*^{80}Ni T : symmetrized from 14Xu07=23.9(+26.0-17.2) **
*^{80}Cu T : other 10Ho12=170(+110-50) **
*^{80}Cu D : %β^-n from 14XuZZ **
*^{80}Zn D : %β^-n from 19To09; others 91Kr15=1.0(0.5) 10Ho12<1.8% **
*^{80}Ga D : %β^-n is probably a mixture of values for ^{80}Ga and ^{80}Ga^m **
*^{80}Rb J : also 81Th04=1 **
*^{80}Y^m J : 228.5 keV M3 to 4- **
*^{80}Zr T : average 01Ki13=5.3(+1.1-0.9) 00Re03=4.1(+0.8-0.6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{81}Ni	−16090#	700#				30#	ms	>410ns	$3/2^+$#		17Su15	I	2017	β^- ?	
^{81}Cu	−31910#	300#				73.2	ms	6.8	$5/2^-$#	10	14Xu07	TD	2010	β^-=100;β^-n=81 20;β^-2n ?	*
^{81}Zn	−46200	5				299.4	ms	2.1	$(1/2^+,5/2^+)$	08	20Pa26	TDJ	1991	β^-=100;β^-n=23 4;β^-2n ?	*
^{81}Ga	−57628	3				1.217	s	0.005	$5/2^-$*	08	20Pa26	T	1976	β^-=100;β^-n=12.5 5	*
^{81}Ge	−66291.7	2.1				9	s	2	$9/2^+$#	08			1972	β^-=100	*
^{81}Ge^m	−65612.6	2.1	679.14	0.04		6	s	2	$(1/2^+)$	08			1981	β^-≈100;IT<1	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{81}As	−72533.3	2.6				33.3 s 0.8	$3/2^-$	08			1960	β^-=100	
^{81}Se	−76389.0	1.0				18.45 m 0.12	$1/2^-$	08			1948	β^-=100	
^{81}Se^m	−76286.0	1.0	103.00	0.06		57.28 m 0.02	$7/2^+$	08			1971	IT≈100;β^-=0.051 14	
^{81}Br	−77977.1	1.0				STABLE	$3/2^-$*	08			1920	IS=49.35 9	
^{81}Br^m	−77440.9	1.0	536.20	0.09		34.6 μs 2.8	$9/2^+$	08			1967	IT=100	
^{81}Kr	−77696.2	1.1				229 ky 11	$7/2^+$*	08	95Ke04	J	1950	ε=100	
^{81}Kr^m	−77505.6	1.1	190.64	0.04		13.10 s 0.03	$1/2^-$*	08	95Ke04	J	1940	IT≈100;ε=0.0025 4	
^{81}Rb	−75457	5				4.572 h 0.004	$3/2^-$*	08			1949	β^+=100	*
^{81}Rb^m	−75371	5	86.31	0.07		30.5 m 0.3	$9/2^+$*	08			1956	IT=97.6 6;β^+=2.4 6	*
^{81}Sr	−71528	3				22.3 m 0.4	$1/2^-$*	08			1952	β^+=100	
^{81}Sr^m	−71449	3	79.23	0.04		390 ns 50	$(5/2)^-$	08			1983	IT=100	
^{81}Sr^n	−71439	3	89.05	0.07		6.4 μs 0.5	$(7/2^+)$	08			1989	IT ?	
^{81}Y	−65713	5				70.4 s 1.0	$(5/2^+)$	08			1981	β^+=100	
^{81}Zr	−57520	90				5.5 s 0.4	$(3/2^-)$	08			1997	β^+=100;β^+p=0.12 2	
^{81}Nb	−46360#	400#				<44ns	$9/2^+$#	08	00We.A	I		p ?;β^+ ?;β^+p ?	*
^{81}Mo	−31460#	500#				1# ms >400ns	$5/2^+$#	15	13Su23	I	2013	β^+ ?;β^+p ?	

*^{81}Cu D : %β^-n from 14XuZZ **
*^{81}Zn D : %β^-n from 20Pa26; others 12Ma37=12(4) 91Kr15=7.5(3.0) 10Ho12=30(13) **
*^{81}Zn T : average 20Pa26=290(4) 14Xu07=303.2(2.6) 10Pa33=304(13) **
*^{81}Ga J : also 17Fa09=3/2 **
*^{81}Ga D : %β^-n average 19To09=11.2(2.6) 93Ru01=12.9(0.8) 81Ho07=12.7(1.2) **
*^{81}Ga D : 80Lu04=12.0(0.9); others 10Ho12<21 86ReZU=11.7(1.2) **
*^{81}Ge T : derived from 81Ho24=7.6(0.6) 72De43=10.1(0.8) for a mixture of gs and **
*^{81}Ge T : isomer that have similar T1/2 **
*^{81}Ge^m T : derived from 81Ho24=7.6(0.6) 72De43=10.1(0.8) for mixture of gs and **
*^{81}Ge^m T : isomer that have similar T1/2 **
*^{81}Rb J : also 81Th04=3/2 **
*^{81}Rb^m J : also 81Th04=9/2 **
*^{81}Nb I : also 99Ja02<80 ns 01Ki13<200 ns **
*^{81}Nb T : estimated β^+ half-life 01Ki13=100# ms **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{82}Ni	−10720#	800#				16# ms >410ns	0^+	19	17Su15	I	2017	β^- ?	
^{82}Cu	−25730#	400#				34 ms 7		19	10Oh02	I	2010	β^-=100;β^-n ?;β^-2n ?	*
^{82}Zn	−42314	3				177.9 ms 2.5	0^+	19	14Xu07	T	1997	β^-=100;β^-n=69 7;β^-2n ?	*
^{82}Ga	−52930.7	2.4				600 ms 2	2^-*	19	12Ch51	J	1976	β^-=100;β^-n=21.2 10; β^-2n ?	*
^{82}Ga^m	−52790.0	2.4	140.7	0.3		93.5 ns 6.7	(4^-)	19	16Al10	TJ	2009	IT=100	*
^{82}Ge	−65415.1	2.2				4.31 s 0.19	0^+	19			1972	β^-=100	*
^{82}As	−70105	4				19.1 s 0.5	(2^-)	19	04Ga44	J	1968	β^-=100	
^{82}As^m	−69973	4	131.6	0.5		13.6 s 0.4	(5^-)	19			1970	β^-=100	
^{82}Se	−77593.9	0.5				87.6 Ey 1.5	0^+	19	20Ba.A	T	1922	IS=8.82 15;2β^-=100	*
^{82}Br	−77498.7	1.0				35.282 h 0.007	5^-*	19	81Th04	J	1937	β^-=100	
^{82}Br^m	−77452.8	1.0	45.9492	0.0010		6.13 m 0.05	2^-	19			1965	IT=97.6 3;β^-=2.4 3	
^{82}Kr	−80591.795	0.006				STABLE	0^+	19			1920	IS=11.593 31	
^{82}Rb	−76188	3				1.2575 m 0.0002	1^+*	19	81Th04	J	1949	β^+=100	
^{82}Rb^m	−76118.8	2.6	69.0	1.5	IT	6.472 h 0.006	5^-*	19	81Th04	J	1957	β^+≈100;IT<0.33	
^{82}Sr	−76010	6				25.35 d 0.03	0^+	19			1952	ε=100	
^{82}Y	−68064	5				8.30 s 0.20	1^+	19			1980	β^+=100	
^{82}Y^m	−67661	5	402.63	0.14		258 ns 22	4^-	19	94Mu02	T	1994	IT=100	*
^{82}Y^n	−67557	5	507.50	0.13		148 ns 6	6^+	19			1994	IT=100	
^{82}Zr	−63614.1	1.6				32 s 5	0^+	19			1982	β^+=100	
^{82}Nb	−51810#	300#				51 ms 5	(0^+)	19			1992	β^+=100;β^+p ?	
^{82}Nb^m	−50630#	300#	1180	1		93 ns 20	(5^+)	19	09Ga40	ETJ	2008	IT=100	*
^{82}Mo	−40370#	400#				30# ms >400ns	0^+	19	13Su23	I	2013	β^+ ?;β^+p ?	

*^{82}Cu T : symmetrized from 14Xu07=33(+7-6) **
*^{82}Zn T : others 16Al10=155(26) 12Ma37=228(10) outweighed (not used) **
*^{82}Ga D : %β^-n average 17Ve01=22(2) 16Te09=22.2(2.0) 86Wa17=19.8(1.7) **
*^{82}Ga D : 80Lu04=21.4(2.2); other 93Ru01=31.1(4.4)% at variance (not used) **
*^{82}Ga^m T : average 16Al10=89(9) 12Ka36=98(+10-9); other 09Fo05<500 ns **
*^{82}Ge T : average 15Et01=4.04(0.27) 80Ze.A=4.5(0.4) 72De43=4.60(0.35); **
*^{82}Ge T : other (not used) 73Kr.A=5(1) **
*^{82}Se T : 2ν-$\beta\beta$ symmetrized from 20Ba.A=87(+2-1) (evaluation); others **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{82}Se	T : 19Az04=86.0(0.3)(+1.9-1.3) 12Si23=96(10) 15Ba11=92(7) (evaluation);														**
*^{82}Se	T : 0nu-BB: 19Az02>3.5 Yy 18Az05>2.4 Yy 99Pi08=83(+9-7) 98Ar10=83(12)														**
*^{82}Se	T : 92El07=108(+26-6) 88Li11=120(10)														**
*^{82}Y^m	T : average 94Mu02=220(50) 93Wo04=268(25)														**
*^{82}Nb^m	T : 09Ga40 superseded 08Ga04=92(17); other 07Ca26=80(50)														**
^{83}Cu	−20390#	500#				21#	ms	>410ns	$5/2^-$#		17Su15	I	2017	β^- ?;β^-n ?;β^-2n ?	
^{83}Zn	−36290#	300#				100	ms	3	$3/2^+$#	15	14XuZZ	TD	1997	β^-=100;β^-n≈71 29;β^-2n ?	*
^{83}Ga	−49257.1	2.6				310.0	ms	0.7	$5/2^-$#	15	17Ve01	TD	1976	β^-=100;β^-n=85 4;β^-2n ?	*
^{83}Ga^m	−49059.8	2.6	197.3	0.5		120	ns	5			16Al10	ETD	2016	IT=100	
^{83}Ge	−60976.4	2.4				1.85	s	0.06	$(5/2^+)$	15			1972	β^-=100;β^-n ?	
^{83}As	−69669.3	2.8				13.4	s	0.4	$5/2^-$#	15			1968	β^-=100	
^{83}Se	−75341	3				22.25	m	0.04	$9/2^+$	15	15Kr02	T	1937	β^-=100	
^{83}Se^m	−75112	3	228.92	0.07		70.1	s	0.4	$1/2^-$	15			1969	β^-=100	
^{83}Br	−79014	4				2.374	h	0.004	$3/2^-$	15			1937	β^-=100	
^{83}Br^m	−75945	4	3069.2	0.4		729	ns	77	$(19/2^-)$	15	11Ru.A	T	1989	IT=100	*
^{83}Kr	−79990.643	0.009				STABLE			$9/2^+$*	15			1920	IS=11.500 19	*
^{83}Kr^m	−79981.238	0.009	9.4053	0.0008		156.8	ns	0.5	$7/2^+$	15			1963	IT=100	
^{83}Kr^n	−79949.086	0.009	41.5575	0.0007		1.830	h	0.013	$1/2^-$*	15	10Li13	T	1971	IT=100	*
^{83}Rb	−79070.6	2.3				86.2	d	0.1	$5/2^-$*	15			1950	ε=100	*
^{83}Rb^m	−79028.5	2.3	42.0780	0.0020		7.8	ms	0.7	$9/2^+$	15	68Et01	T	1968	IT=100	
^{83}Sr	−76798	7				32.41	h	0.03	$7/2^+$*	15			1952	β^+=100	*
^{83}Sr^m	−76539	7	259.15	0.09		4.95	s	0.12	$1/2^-$*	15			1972	IT=100	*
^{83}Y	−72206	19				7.08	m	0.08	$(9/2^+)$	15	92Bu10	J	1962	β^+=100	
^{83}Y^m	−72144	19	62.04	0.10		2.85	m	0.02	$(3/2^-)$	15			1972	β^+=60 5;IT=40 5	
^{83}Zr	−65912	6				42	s	2	$1/2^-$#	15			1974	β^+=100;β^+p=?	
^{83}Zr^m	−65859	6	52.72	0.05		530	ns	120	$(5/2^-)$	15			1988	IT=100	
^{83}Zr^n	−65835	6	77.04	0.07		1.8	μs	0.1	$(7/2^+)$	15			1988	IT=100	
^{83}Nb	−57610	160				3.9	s	0.2	$9/2^+$#	15			1988	β^+=100	
^{83}Mo	−46340#	400#				23	ms	19	$3/2^-$#	15	01Ki13	TD	1999	β^+=100;β^+p ?	*
^{83}Tc	−31320#	500#							$1/2^-$#					p ?;β^+ ?;β^+p ?	
*^{83}Zn	T : average 16Al10=122(28) 14XuZZ=99.4(3.0) 12Ma37=117(20)														**
*^{83}Ga	T : average 17Ve01=312(1) 16Al10=309(6) 14Xu.A=296.1(6.4) 06Pe20=317(17)														**
*^{83}Ga	T : 319(24) 93Ru01=307(7) 91Kr15=308(1) 86Wa17,80Lu04,76Ru01=310(10)														**
*^{83}Ga	D : %β^-n others 16Ma50=56(7) 09Wi03=62.8(2.5) 80Lu04=43(7) 93Ru01=14.9(1.8)														**
*^{83}Br^m	T : average 11Ru.A=862(148) 97Is13=700(100) 89Wi01=600(200)														**
*^{83}Kr	J : also 95Ke04=9/2														**
*^{83}Kr^n	T : average 10Li13=1.82(0.02) 09Ka30=1.85(0.03) 71Ru17=1.83(0.02)														**
*^{83}Kr^n	J : 95Ke04=1/2														**
*^{83}Rb	J : also 81Th04=5/2														**
*^{83}Sr	J : 90Li28=7/2														**
*^{83}Sr^m	J : 90Li28=1/2														**
*^{83}Mo	T : symmetrized from 01Ki13=6(+30-3)														**
^{84}Cu	−13720#	500#												β^- ?;β^-n ?	
^{84}Zn	−31830#	400#				54	ms	8	0^+	10	14XuZZ	TD	2010	β^-=100;β^-n=73 26;β^-2n ?	
^{84}Ga	−44094	30				97.6	ms	1.2	0^-#	09	19Yo03	TD	1991	β^-=100;β^-n=43 4; β^-2n=1.6 2	*
^{84}Ga^m			*non − exist*		RN	< 85	ms		$(3^-,4^-)$	09	09Le26	TD		β^- ?; IT ?	*
^{84}Ge	−58148	3				951	ms	9	0^+	09	13Ma22	T	1972	β^-=100;β^-n=10.6 6	*
^{84}As	−65854	3				3.16	s	0.58	(2^-)	09	16Ko24	J	1968	β^-=100;β^-n=0.28 4	*
^{84}As^m			*non − exist*		RN	650	ms	150		09	74KrZG	IT	1974	β^-=100	*
^{84}Se	−75947.7	2.0				3.26	m	0.10	0^+	09			1960	β^-=100	
^{84}Br	−77783	26				31.76	m	0.08	2^-	09			1943	β^-=100	
^{84}Br^m	−77470	100	310	100	BD	6.0	m	0.2	$(6)^-$	09			1957	β^-=100	
^{84}Br^n	−77375	26	408.2	0.4		< 140	ns		1^+	09			1970	IT=100	
^{84}Kr	−82439.345	0.004				STABLE			0^+	09			1920	IS=56.987 15	
^{84}Kr^m	−79203.27	0.18	3236.07	0.18		1.83	μs	0.04	8^+	09			1982	IT=100	
^{84}Rb	−79759.0	2.2				32.82	d	0.07	2^-*	09			1947	β^+=96.1 20;β^-=3.9 20	*
^{84}Rb^m	−79295.4	2.2	463.59	0.08		20.26	m	0.04	6^-*	09			1940	IT≈100;β^+<0.0012	*
^{84}Sr	−80649.6	1.2				STABLE			0^+	09			1936	IS=00.56 2;2β^+ ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{84}Y	−73894	4			39.5	m	0.8	(6$^+$)	09			1962	β^+=100	
^{84}Y^m	−73827	4	67.0	0.2	4.6	s	0.2	1$^+$	09			1976	β^+=100	
^{84}Y^n	−73684	4	210.42	0.16	292	ns	10	(4$^-$)	09			2005	IT=100	
^{84}Zr	−71422	5			25.8	m	0.5	0$^+$	09			1977	β^+=100	
^{84}Nb	−61193.8	0.4			9.8	s	0.9	(1$^+$)	09	09St04	J	1977	β^+=100	
^{84}Nb^m	−61145.8	1.1	48	1	176	ns	46	(3$^+$)		09Ga40	ETJ	2009	IT=100	
^{84}Nb^n	−60856.1	0.6	337.7	0.4	92	ns	5	(5$^-$)	09	09Ga40	T	2000	IT=100	
^{84}Mo	−54170#	300#			2.3	s	0.3	0$^+$	09			1991	β^+=100;β^+p ?	
^{84}Tc	−37700#	400#						1$^+$#					p ?;β^+ ?;β^+p ?	

*^{84}Ga D : %β^-n average 19Yo03=44(4) and 16Ma50=40(7) (same group as 19Yo03, but **
*^{84}Ga D : different experiment); others 17Ve01=53(20) 10Wi03=74(14) **
*^{84}Ga D : 09Gr06=80(15) 91Kr15=70(15) **
*^{84}Ga^m I : proposed in 09Le26 (and Ensdf2009), but not confirmed in 10Wi03 data **
*^{84}Ga^m I : of much bigger statistics **
*^{84}Ge T : average 13Ma22=942(17) 93Ru01=947(11) 91Kr15=984(23) **
*^{84}Ge D : %β^-n average 93Ru01=10.8(0.6) 91Kr15=9.5(2.0) 91Om01=9(3) **
*^{84}As T : from 13Ma22; others: 96WaZX=3.24(0.26) 93Ru01=4.02(0.03) 91Om01=4.5(0.2) **
*^{84}As T : 81Ho10=4.5(0.2) 75Kr08=5.3(0.4) 68De19=5.8(0.5) **
*^{84}As D : %β^-n from 91Ru01; others 02Pf04=0.18(0.10) 73Kr06=0.13(0.06) **
*^{84}As^m I : from 74KrZG (also 75Kr08), but not confirmed in 81Ho10 **
*^{84}Rb J : other 14Ya28=1.9(1),81Th04=2 **
*^{84}Rb^m J : other 14Ya28=6.2(2),81Th04=6 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{85}Zn	−25100#	500#			40#	ms	>400ns	5/2$^+$#	14	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{85}Ga	−39740	40			95.3	ms	1.0	(5/2$^-$)	14	19Yo03	TD	1997	β^-=100;β^-n=77 4; β^-2n=1.3 2	*
^{85}Ge	−53123	4			495	ms	5	(3/2$^+$,5/2$^+$)#	14	13Ma22	T	1991	β^-=100;β^-n=17.2 18; β^-2n ?	*
^{85}As	−63189	3			2.022	s	0.007	(5/2$^-$)	14	12Ku06	J	1967	β^-=100;β^-n=62.6 9	*
^{85}Se	−72413.6	2.6			32.9	s	0.3	(5/2)$^+$	14			1960	β^-=100	
^{85}Br	−78575	3			2.90	m	0.06	3/2$^-$	14			1943	β^-=100	
^{85}Kr	−81480.3	2.0			10.728	y	0.007	9/2$^+$*	14	FGK209	T	1940	β^-=100	*
^{85}Kr^m	−81175.4	2.0	304.871	0.020	4.480	h	0.008	1/2$^-$*	14	95Ke04	J	1937	β^-=78.8 5;IT=21.2 5	
^{85}Kr^n	−79488.5	2.0	1991.8	0.2	1.82	μs	0.05	(17/2$^+$)	14	11Ru.A	T	1989	IT=100	
^{85}Rb	−82167.341	0.005			STABLE			5/2$^-$*	14			1921	IS=72.17 2	*
^{85}Rb^m	−81653.335	0.005	514.0065	0.0022	1.015	μs	0.001	9/2$^+$	14	19Ta19	T	1964	IT=100	*
^{85}Sr	−81103.3	2.8			64.846	d	0.006	9/2$^+$*	14	FGK204	T	1940	ε=100	*
^{85}Sr^m	−80864.5	2.8	238.79	0.05	67.63	m	0.04	1/2$^-$*	14			1940	IT=86.6 4;β^+=13.4 4	*
^{85}Y	−77842	19			2.68	h	0.05	(1/2)$^-$	14			1952	β^+=100	
^{85}Y^m	−77822	19	19.68	0.17	4.86	h	0.20	(9/2)$^+$	14			1952	$\beta^+\approx$100; IT ?	
^{85}Y^n	−77576	19	266.18	0.10	178	ns	7	(5/2)$^-$	14			1977	IT=100	
^{85}Zr	−73175	6			7.86	m	0.04	(7/2$^+$)	14			1963	β^+=100	
^{85}Zr^m	−72883	6	292.2	0.3	10.9	s	0.3	1/2$^-$#	14			1976	IT=?;β^+=?	
^{85}Nb	−66280	4			20.5	s	0.7	9/2$^+$#	14			1988	β^+=100	*
^{85}Nb^m	−66130#	80#	150#	80#	3.3	s	0.9	(1/2$^-$)	14	05Ka39	J	1988	IT=?;β^+=?	*
^{85}Nb^n			*non − exist*	RN	12	s	5		14	98Oi02	IT		β^- ?; IT ?	*
^{85}Mo	−57510	16			3.2	s	0.2	(1/2$^+$)	14	05Xu04	J	1992	β^+=100;β^+p=0.14 2	
^{85}Tc	−45850#	400#					<110ns	1/2$^-$#	14	00We.A	I		p ?	*
^{85}Ru	−30630#	500#			1#	ms	>400ns	3/2$^-$#	15	13Su23	I	2013	β^+ ?;β^+p ?;p ?	

*^{85}Ga D : %β^-n average 19Yo03=90(7)% 18Mi03=70(5)% **
*^{85}Ge D : %β^-n from 14Ag12; others 18Mi03=15(5) 91Kr15=14(3) **
*^{85}Ge T : average 14XuZZ=495(6) 13Ma22=494(8);others 91Kr15=535(47) 91Om01=580(50) **
*^{85}As D : %β^-n average 14Ag12=63.1(1.0) 93Ru01=59.3(2.5) **
*^{85}As T : average 13Ma22=2.08(0.14) 93Ru01=2.002(0.013) 91Kr15=2.032(0.012) **
*^{85}As T : 68To19=2.028(0.012); others 73Kr06=2.05(0.05), superseded by 91Kr15 **
*^{85}As T : 76Ru01=2.08(0.05),superseded by 93Ru01 91Om01=2.0(0.1) 78Cr03=1.9(0.1) **
*^{85}Kr J : also 95Ke04=9/2 **
*^{85}Rb J : also 14Ya28=2.5(1),81Th04=5/2 **
*^{85}Rb^m T : average 19Ta19=1.0202(0.0060) 72Mi23=1.015(0.001) **
*^{85}Sr J : 90Li28=9/2 **
*^{85}Sr^m J : 90Li28=1/2 **
*^{85}Nb T : average 05Ka39=17(2) 88Ku14=20.9(0.7) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

(Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{85}Nb^m$	E : from 05Ka39 $>$ 69 keV														**
$*^{85}Nb^n$	I : activity reported in 98Oi02 and adopted in Ensdf2014 as a new isomer;														**
$*^{85}Nb^n$	I : not confirmed in 05Ka39 (the same laboratory as 98Oi02)														**
$*^{85}Tc$	I : also 99Ja02$<$100 ns; estimated T1/2=100# ms for β^+ decay														**
^{86}Zn	−20060#	500#							0^+					β^- ?;β^-n ?	
^{86}Ga	−33760#	400#				49	ms	2		15	19Yo03	TD	1997	β^-=100;β^-n=69 6; β^-2n=16.2 11	*
^{86}Ge	−49400	440				221.6	ms	11	0^+	15	14XuZZ	T	1994	β^-=100;β^-n=45 15	*
^{86}As	−58962	3				945	ms	8	$(1^-,2^-)$	15	15Ma61	J	1973	β^-=100;β^-n=35.5 6;β^-2n ?	
^{86}Se	−70503.2	2.5				14.3	s	0.3	0^+	16			1973	β^-=100;β^-n ?	
^{86}Br	−75632	3				55.1	s	0.4	(1^-)	15			1962	β^-=100	
^{86}Kr	−83265.676	0.004				STABLE			0^+	15			1920	IS=17.279 41;2β^- ?	
^{86}Rb	−82747.00	0.20				18.645	d	0.008	2^-*	15			1941	$\beta^-\approx$100;ε=0.0052 5	*
$^{86}Rb^m$	−82190.95	0.27	556.05	0.18		1.017	m	0.003	6^-*	15			1951	IT$\approx$100;$\beta^-$$<$0.3	
^{86}Sr	−84523.100	0.005				STABLE			0^+	15			1931	IS=9.86 20	
$^{86}Sr^m$	−81567.01	0.12	2956.09	0.12		455	ns	7	8^+	15			1971	IT=100	
^{86}Y	−79283	14				14.74	h	0.02	4^-*	15			1951	β^+=100	*
$^{86}Y^m$	−79065	14	218.21	0.09		47.4	m	0.4	(8^+)	15			1962	IT=99.31 4;β^+=0.69 4	
$^{86}Y^n$	−78981	14	302.18	0.09		125.3	ns	5.5	6^+	15	10Ru07	J	2000	IT=100	*
^{86}Zr	−77969	4				16.5	h	0.1	0^+	15			1951	β^+=100	
^{86}Nb	−69134	5			*	88	s	1	(6^+)	15			1974	β^+=100	
$^{86}Nb^m$	−68980#	100#	150#	100#	*	20#	s		$(0^-,1^-,2^-)$	15	05Ka39	J	1994	β^+=100; IT ?	*
$^{86}Nb^n$			*non − exist*		RN	56.3	s	8.3		15	94Sh07	IT		β^+= ?; IT ?	*
^{86}Mo	−64110.9	2.9				19.1	s	0.3	0^+	15			1991	β^+=100	
^{86}Tc	−51570#	300#				55	ms	7	(0^+)	15			1992	β^+=100;β^+p ?	
$^{86}Tc^m$	−50050#	300#	1524	10		1.10	μs	0.12	(6^+)	15	08Ga04	T	2000	IT=100	*
^{86}Ru	−39770#	400#				50#	ms	>400ns	0^+	15	13Su23	I	2013	β^+ ?;β^+p ?	
$*^{86}Ga$	D : %β^-n average 19Yo03=74(8) 13Mi19=60(10)														**
$*^{86}Ge$	T : other 13Ma22=226(21), supersedes 12Ma.A=219(40)														**
$*^{86}Rb$	J : also 14Ya28=1.9(2),81Th04=2														**
$*^{86}Rb$	T : average 16Ma49=18.648(0.009) 81Mi10=18.631(0.018)														**
$*^{86}Y$	J : 07Ch07=4														**
$*^{86}Y^n$	T : average 10Ru07=127(14) 00Io02=125(6)														**
$*^{86}Nb^m$	I : from 94Sh07 and 05Ka39, populated in β^+ decay of ^{86}Mo (0+)														**
$*^{86}Nb^n$	I : half-life deduced in 94Sh07 by gating on Zr X-rays, which would be														**
$*^{86}Nb^n$	I : consistent with decay of two isomers, one with T1/2=88 s and the														**
$*^{86}Nb^n$	I : second with a half-life similar to that of ^{86}Mo, T1/2=19.1 s;														**
$*^{86}Nb^n$	I : not confirmed in 05Ka39, 97Ta10 (sensitive to high-spin structures)														**
$*^{86}Tc^m$	T : average 08Ga04=1.10(0.14) 00Ch07=1.11(0.21)														**
$*^{86}Tc^m$	E : uncertainty estimated by GAu														**
^{87}Ga	−28870#	500#				29	ms	4	$5/2^-$#	15	19Yo03	TD	2010	β^-=100;β^-n=81 12; β^-2n=10.2 2.8	
^{87}Ge	−43590#	300#				103	ms	4	$5/2^+$#	15	14XuZZ	T	1997	β^-=100;β^-n ?;β^-2n ?	
^{87}As	−55617.9	3.0				492	ms	25	$(5/2^-,3/2^-)$	15	15Ko19	TJ	1970	β^-=100;β^-n=15.4 22; β^-2n ?	*
^{87}Se	−66426.1	2.2				5.50	s	0.06	$(3/2^+)$	15	15Ko19	J	1968	β^-=100;β^-n=0.60 12	*
^{87}Br	−73892	3				55.68	s	0.12	$5/2^-$	15	19Wi11	J	1943	β^-=100;β^-n=2.60 4	
^{87}Kr	−80709.53	0.25				76.3	m	0.5	$5/2^+*$	15			1940	β^-=100	
^{87}Rb	−84597.802	0.006				49.7	Gy	0.3	$3/2^-*$	15			1921	IS=27.83 2;β^-=100	*
^{87}Sr	−84880.076	0.005				STABLE			$9/2^+*$	15			1931	IS=7.00 20	*
$^{87}Sr^m$	−84491.547	0.006	388.5287	0.0023		2.805	h	0.009	$1/2^-*$	15	21Kr.A	T	1940	IT=99.70 8;ε=0.30 8	*
^{87}Y	−83018.4	1.1				79.8	h	0.3	$1/2^-*$	15			1940	β^+=100	*
$^{87}Y^m$	−82637.6	1.1	380.82	0.07		13.37	h	0.03	$9/2^+*$	15			1940	IT=98.43 11;β^+=1.57 11	*
^{87}Zr	−79347	4				1.68	h	0.01	$9/2^+$	15			1948	β^+=100	
$^{87}Zr^m$	−79011	4	335.84	0.19		14.0	s	0.2	$1/2^-$	15			1972	IT=100	
^{87}Nb	−73874	7				3.7	m	0.1	$(1/2)^-$	15			1971	β^+=100	
$^{87}Nb^m$	−73870	7	3.9	0.1		2.6	m	0.1	$(9/2)^+$	15			1972	β^+=100	
^{87}Mo	−66884.8	2.9				14.1	s	0.3	$7/2^+$#	15			1977	β^+=100;β^+p=15 5	
^{87}Tc	−57690	4			*	2.14	s	0.17	$9/2^+$#	15	19Pa16	TD	1991	β^+=100;β^+p$<$0.7	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{87}Tc^m	−57683	4	7	1	*	2#	s		$1/2^-$#		09Ga40	E		β^+ ?;IT ?	*
^{87}Tc^n	−57619	4	71	1		647	ns	24	$7/2^+$#	15			2007	IT=100	
^{87}Ru	−45730#	400#				50#	ms	>1.5us	$1/2^-$#	15	95Ry03	I	1995	β^+ ?;β^+p ?	
*^{87}As	T : average 15Ko19=560(80) 13Ma22=484(35) 93Ru01=485(40); others														**
*^{87}As	T : 12Qu01=1450(550)(+3900-1100) 78Cr03=730(60)														**
*^{87}Se	T : average 93Ru01=5.29(11) 70Kr05=5.85(15) 70De08=5.90(20) 71To13=5.41(10)														**
*^{87}Se	D : %β^-n from 93Ru01														**
*^{87}Rb	J : also 14Ya28=1.53(6)														**
*^{87}Sr	J : 90Li28=9/2														**
*^{87}Sr^m	J : 90Li28=1/2														**
*^{87}Sr^m	T : average 21Kr.A=2.808(0.003) 97We13=2.811(0.027) 82Gr07=2.795(0.013)														**
*^{87}Sr^m	T : 70Le07=2.793(0.009) 68Go30=3.805(0.001); other 92An19=2.827(0.001),														**
*^{87}Sr^m	T : discrepant (not used)														**
*^{87}Y	J : 07Ch07=1/2														**
*^{87}Y^m	J : 07Ch07=9/2														**
*^{87}Tc	T : average 19Pa16=2.0(0.3) 01Ki13=2.2(0.2)														**
*^{87}Tc^m	E : 64 keV gamma ray observed in parallel to the 71 keV one, depopulating														**
*^{87}Tc^m	E : ^{87}Tc^n														**
^{88}Ga	−22390#	500#												β^- ?;β^-n ?	
^{88}Ge	−39520#	400#				61	ms	6	0^+	14	14XuZZ	T	1997	β^-=100;β^-n ?;β^-2n ?	
^{88}As	−50450#	200#				270	ms	150		14	12Qu01	T	1994	β^-=100;β^-n ?	*
^{88}Se	−63884	3				1.53	s	0.06	0^+	14			1970	β^-=100;β^-n=0.99 10	
^{88}Br	−70716	3				16.34	s	0.08	(1^-)	14	15Cz01	J	1948	β^-=100;β^-n=6.58 18	
^{88}Br^m	−70446	3	270.17	0.11		5.51	μs	0.04	(4^-)	14	11Ru.A	T	1970	IT=100	*
^{88}Kr	−79691.3	2.6				2.825	h	0.019	0^+	14			1939	β^-=100	
^{88}Rb	−82609.00	0.16				17.78	m	0.03	2^-*	14	20Ch42	T	1939	β^-=100	*
^{88}Rb^m	−81235.2	0.3	1373.8	0.3		123	ns	13	(7^+)	14			2000	IT=100	
^{88}Sr	−87921.629	0.006				STABLE			0^+	14			1923	IS=82.58 35	
^{88}Y	−84299.0	1.5				106.629	d	0.024	4^-*	14	FGK204	T	1948	β^+=100	*
^{88}Y^m	−83906.1	1.5	392.86	0.09		301	μs	3	1^+	14			1955	IT=100	
^{88}Y^n	−83624.5	1.5	674.55	0.04		13.98	ms	0.17	8^+*	14			1962	IT=100	*
^{88}Zr	−83629	5				83.4	d	0.3	0^+	14			1951	ε=100	
^{88}Zr^m	−80741	5	2887.79	0.06		1.320	μs	0.025	8^+	14			1978	IT=100	*
^{88}Nb	−76170	60			*	14.50	m	0.11	(8^+)	14			1964	β^+=100	
^{88}Nb^m	−76040	100	130	120	BD*	7.7	m	0.1	(4^-)	14			1971	β^+=100	
^{88}Mo	−72687	4				8.0	m	0.2	0^+	14			1971	β^+=100	
^{88}Tc	−61670	4				6.4	s	0.8	(2^+)	14	09Ga40	J	1991	β^+=100;β^+p ?	
^{88}Tc^m	−61600	5	70	3	MD	5.8	s	0.2	(6^+)	14	19Vi05	J	1993	β^+=100;β^+p ?	
^{88}Tc^n	−61575	4	95	1		146	ns	12	(4^+)	14	09Ga40	TJ	2009	IT=100	
^{88}Ru	−54340#	300#				1.5	s	0.3	0^+	14	19Pa16	TD	1994	β^+=100;β^+p<3.6	*
^{88}Rh	−36860#	400#				1#	ms							β^+ ?	
*^{88}As	T : symmetrized from 12Qu01=200(5)(+200-90)														**
*^{88}Br^m	J : 15Cz01=(4-)														**
*^{88}Br^m	T : also 18Rz01=5.5(0.1)														**
*^{88}Rb	J : also 81Th04=2														**
*^{88}Rb	T : average 20Ch42=17.78(0.05) 89Ab22=17.773(0.033), uncertainty increased														**
*^{88}Rb	T : to 3σ by evaluator, 69Ra05=17.78(0.11); other 69He16=17.7(0.1)														**
*^{88}Y	J : 07Ch07=4														**
*^{88}Y^n	J : 07Ch07=8														**
*^{88}Zr^m	T : other 17Pa35=1.40(0.07)														**
*^{88}Ru	T : average 19Pa16=1.9(0.5) 01Ki13=1.2(+0.3-0.2)														**
^{89}Ge	−33040#	400#				60#	ms	>300ns	$3/2^+$#	13			1997	β^- ?;β^-n ?;β^-2n ?	
^{89}As	−46530#	300#				220#	ms	>150ns	$5/2^-$#	13	94Be24	I	1994	β^- ?;β^-n ?;β^-2n ?	
^{89}Se	−58992	4				430	ms	50	$5/2^+$#	13			1971	β^-=100;β^-n=7.8 25	
^{89}Br	−68274	3				4.357	s	0.022	$(3/2^-,5/2^-)$	13			1959	β^-=100;β^-n=13.8 4	
^{89}Kr	−76535.8	2.1				3.15	m	0.04	$3/2^+$*	13	95Ke04	J	1940	β^-=100	
^{89}Rb	−81712	5				15.32	m	0.10	$3/2^-$*	13			1940	β^-=100	*
^{89}Sr	−86209.03	0.09				50.563	d	0.025	$5/2^+$*	13			1937	β^-=100	
^{89}Y	−87711.2	0.3				STABLE			$1/2^-$*	13			1923	IS=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{89}Y^m	−86802.2	0.3	908.97	0.03		15.663	s	0.005	9/2$^+$*	13	94It.A	T	1951	IT=100	*
^{89}Zr	−84878.0	2.8				78.360	h	0.023	9/2$^+$	13	20Fe10	T	1948	β^+=100	*
^{89}Zr^m	−84290.2	2.8	587.82	0.10		4.161	m	0.010	1/2$^-$	13			1953	IT=93.77 12;β^+=6.23 12	
^{89}Nb	−80626	24			*	2.03	h	0.07	(9/2$^+$)	13			1954	β^+=100	
^{89}Nb^m	−80630#	40#	0#	30#	*	1.10	h	0.03	(1/2)$^-$	13			1954	β^+=100	
^{89}Mo	−75015	4				2.11	m	0.10	(9/2$^+$)	13			1980	β^+=100	
^{89}Mo^m	−74628	4	387.5	0.2		190	ms	15	(1/2$^-$)	13			1980	IT=100	
^{89}Tc	−67395	4				12.8	s	0.9	(9/2$^+$)	13			1991	β^+=100	
^{89}Tc^m	−67332	4	62.6	0.5		12.9	s	0.8	(1/2$^-$)	13			1991	$\beta^+\approx$100;IT ?	
^{89}Ru	−58369	24				1.32	s	0.03	(9/2$^+$)	13	19Pa16	TD	1992	β^+=100;β^+p=3.1 2	
^{89}Rh	−45650#	360#				<120ns			9/2$^+$#	16	16Ce02	TI		β^+ ?;β^+p ?;p ?	
*^{89}Rb	J : also 81Th04=3/2														**
*^{89}Y	J : 07Ch07=1/2														**
*^{89}Y^m	J : 07Ch07=9/2														**
*^{89}Zr	T : average 20Fe10=78.368(0.032) 18Ga04=78.333(0.038) 64Va03=78.43(0.08)														**
^{90}Ge	−28470#	500#				30#	ms	>400ns	0$^+$	20	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{90}As	−40990#	400#				70#	ms	>300ns		20	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{90}As^m	−40870#	400#	124.5	0.5		220	ns	100			12Ka36	ET	2012	IT=100	*
^{90}Se	−55800	330				210	ms	80	0$^+$	20	12Qu01	T	1994	β^-=100;β^-n ?	*
^{90}Br	−64000	3				1.910	s	0.010		20			1959	β^-=100;β^-n=25.3 15	
^{90}Kr	−74959.3	1.9				32.32	s	0.09	0$^+$	20			1951	β^-=100	
^{90}Rb	−79366	6				158	s	5	0$^-$*	20			1951	β^-=100	*
^{90}Rb^m	−79259	6	106.90	0.03		258	s	4	3$^-$*	20			1967	β^-=97.4 4;IT=2.5 4	*
^{90}Rb^x	−79295	14	71	12		$R=2$		1	*fsmix*						
^{90}Sr	−85950.9	1.4				28.91	y	0.03	0$^+$	20			1948	β^-=100	
^{90}Y	−86496.9	0.4				64.05	h	0.05	2$^-$*	20			1937	β^-=100	*
^{90}Y^m	−85814.9	0.4	682.01	0.05		3.226	h	0.011	7$^+$*	20	20Kr06	T	1961	IT=99.9982 2;β^-=0.0018 2	*
^{90}Zr	−88772.55	0.12				STABLE			0$^+$	20			1924	IS=51.45 4	
^{90}Zr^m	−86453.55	0.12	2319.000	0.009		809.2	ms	2.0	5$^-$	20			1972	IT=100	
^{90}Zr^n	−85183.13	0.12	3589.418	0.015		131	ns	4	8$^+$	20			1977	IT=100	
^{90}Nb	−82662	3				14.60	h	0.05	8$^+$*	20			1951	β^+=100	*
^{90}Nb^m	−82540	3	122.370	0.022		63	μs	2	6$^+$	20			1967	IT=100	
^{90}Nb^n	−82537	3	124.67	0.25		18.81	s	0.06	4$^-$*	20			1969	IT=100	*
^{90}Nb^p	−82491	3	171.10	0.10		< 1	μs		7$^+$	20			1981	IT=100	
^{90}Nb^q	−82280	3	382.01	0.25		6.19	ms	0.08	1$^+$	20			1967	IT=100[gs=0,m=100]	
^{90}Nb^r	−80782	3	1880.21	0.20		471	ns	6	(11$^-$)	20	05Ch65	TJ	1978	IT=100	*
^{90}Mo	−80173	3				5.56	h	0.09	0$^+$	20			1953	β^+=100	
^{90}Mo^m	−77298	3	2874.73	0.15		1.14	μs	0.05	8$^+$	20			1971	IT=100	
^{90}Tc	−70724.7	1.0				49.2	s	0.4	(8$^+$)	20			1974	β^+=100	
^{90}Tc^m	−70580.7	1.3	144.0	1.7	MD	8.7	s	0.2	1$^+$	20			1974	β^+=100	
^{90}Ru	−64884	4				11.7	s	0.9	0$^+$	20			1991	β^+=100	
^{90}Rh	−51630#	200#			*	29	ms	3	(0$^+$)	20	19Pa16	JTD	1994	β^+=100;β^+p<0.7	
^{90}Rh^m	−51630#	540#	0#	500#	*	0.56	s	0.02	(7$^+$)	20	19Pa16	JTD	2001	β^+=100;β^+p=9.6 10	
^{90}Pd	−39710#	400#				10#	ms	>400ns	0$^+$	20	16Ce02	I	2016	β^+ ?;β^+p ? 2p ?	
*^{90}As^m	T : symmetrized from 12Ka36=200(+120-90)														**
*^{90}Se	T : symmetrized from 12Qu01=195(7,stat)(+95-65,syst)														**
*^{90}Rb	J : also 81Th04=0														**
*^{90}Rb^m	J : also 81Th04=3														**
*^{90}Y	J : also 07Ch07,78Fu06=2														**
*^{90}Y^m	J : 07Ch07=7														**
*^{90}Y^m	T : average 20Kr06=3.178(0.012) 92An19=3.244(0.005) 67Gr02=3.19(0.01)														**
*^{90}Y^m	T : 62Ab03=3.15(0.05) 61Ca12=3.2(0.1) 61He09=3.14(0.10) 61Ha17=3.19(0.06);														**
*^{90}Y^m	T : Birge ratio=2.75														**
*^{90}Nb	J : also 09Ch25=8														**
*^{90}Nb^n	J : 09Ch25=4														**
*^{90}Nb^r	T : average 05Ch65=470(10) 81Fi02=440(20) 78Ha52=477(8); other														**
*^{90}Nb^r	T : 17Pa35=415(67)														**
^{91}As	−36500#	400#				100#	ms	>300ns	5/2$^-$#	13	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{91}Se	−50580	430				270	ms	50	1/2$^+$#	13			1975	β^-=100;β^-n=21 10;β^-2n ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{91}Br	−61107	4				543	ms	4	5/2$^-$#	13	14Ag12	D	1974	β^-=100;β^-n=29.5 5	
^{91}Kr	−70974.0	2.2				8.57	s	0.04	5/2$^+$*	13			1951	β^-=100;β^-n ?	
^{91}Rb	−77745	8				58.2	s	0.3	3/2$^-$*	13			1951	β^-=100;β^-n ?	*
^{91}Sr	−83652	5				9.65	h	0.06	5/2$^+$*	13	19Kr10	T	1943	β^-=100	*
^{91}Y	−86351.3	1.8				58.51	d	0.06	1/2$^-$*	13			1943	β^-=100	
^{91}Y^m	−85795.7	1.8	555.58	0.05		49.71	m	0.04	9/2$^+$	13			1953	IT≈100;β^- ?	
^{91}Zr	−87895.59	0.09				STABLE			5/2$^+$*	13			1934	IS=11.22 5	
^{91}Zr^m	−84728.3	0.4	3167.3	0.4		4.35	μs	0.14	(21/2$^+$)	13			1985	IT=100	
^{91}Nb	−86638.0	2.9				680	y	130	9/2$^+$*	13	91Hi.A	D	1951	ε≈100;e$^+$=0.0138 25	*
^{91}Nb^m	−86533.4	2.9	104.60	0.05		60.86	d	0.22	1/2$^-$*	13	91Hi.A	D	1950	IT=96.6 5;ε=3.4 5; e$^+$=0.0028 2	*
^{91}Nb^n	−84603.6	2.9	2034.42	0.20		3.76	μs	0.12	(17/2$^-$)	13			1974	IT=100	
^{91}Mo	−82209	6				15.49	m	0.01	9/2$^+$	13			1948	β^+=100	
^{91}Mo^m	−81556	6	653.01	0.09		64.6	s	0.6	1/2$^-$	13			1953	IT=50.0 16;β^+=50.0 16	
^{91}Tc	−75986.7	2.4				3.14	m	0.02	(9/2)$^+$	13			1974	β^+=100	
^{91}Tc^m	−75847.4	2.4	139.3	0.3		3.3	m	0.1	(1/2)$^-$	13			1975	β^+≈100;IT ?	
^{91}Ru	−68239.8	2.2			*	8.0	s	0.4	(9/2$^+$)	13			1983	β^+=100;β^+p ?	
^{91}Ru^m	−68580	500	−340	500	BD*	7.6	s	0.8	(1/2$^-$)	13			1983	β^+≈100;β^+p=?;IT ?	
^{91}Rh	−58570#	300#				1.47	s	0.22	(9/2$^+$)	13	04De40	TJ	1994	β^+=100;β^+p=1.3 5	*
^{91}Rh^m	−58400#	300#	172.9	0.4		1.8#	s		1/2$^-$#	13			2004	β^+ ?;IT ?;β^+p ?	*
^{91}Pd	−46170#	420#				32	ms	3	7/2$^+$#	13	18Pa20	TD	1995	β^+=100;β^+p=3.1 10	*

*^{91}Rb J : other 81Th04=3/2 **
*^{91}Sr J : 90Li28=5/2 **
*^{91}Sr T : other 19Kr10=9.66(0.09) **
*^{91}Zr J : 02Ca37=5/2 **
*^{91}Nb J : 09Ch25=9/2 **
*^{91}Nb^m J : 09Ch25=1/2 **
*^{91}Rh T : from 04De40=1.47(0.22) using time spectra gated by gamma rays feeding **
*^{91}Rh T : the ^{91}Ru gs (9/2+); others: 19Pa16=1.60(0.02) 01Ki13=1.7(0.2) **
*^{91}Rh T : 00We.A=1.74(0.14) (same group as 01Ki13) probably include both gs **
*^{91}Rh T : and isomer **
*^{91}Rh^m T : Ensdf2013 assign T1/2=1.47(0.22) from 04De40, but this value is **
*^{91}Rh^m T : unambiguously associated in 04De04 with the decay of the 9/2+ gs. **
*^{91}Rh^m T : 19Pa16=1.60(0.02) 01Ki13=1.7(0.2) 00We.A=1.74(0.14) probably include **
*^{91}Rh^m T : both gs and isomer **
*^{91}Pd D : %β^+p symmetrized from 18Pa20=3.0(+1.1-0.9) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{92}As	−30380#	500#				45#	ms	>300ns		12	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{92}Se	−46720#	400#				90#	ms	>300ns	0$^+$	12	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{92}Se^m	−44780#	400#	3072	2		15.7	μs	0.7	(9$^-$)		20Li15	ETJ	2012	IT=100	*
^{92}Br	−56233	7				314	ms	16	(2$^-$)	12			1974	β^-=100;β^-n=33.1 25; β^-2n ?	
^{92}Br^m	−55571	7	662	1		88	ns	8			12Ka36	ET	2012	IT=100	*
^{92}Br^n	−55095	7	1138	1		85	ns	10			12Ka36	ET	2012	IT=100	*
^{92}Kr	−68769.3	2.7				1.840	s	0.008	0$^+$	12			1951	β^-=100;β^-n=0.0332 25	
^{92}Rb	−74772	6				4.48	s	0.03	0$^-$*	12			1960	β^-=100;β^-n=0.0107 5	*
^{92}Sr	−82867	3				2.611	h	0.017	0$^+$	12			1956	β^-=100	*
^{92}Y	−84816	9				3.54	h	0.01	2$^-$*	12			1940	β^-=100	*
^{92}Y^m	−84010#	50#	807#	50#		3.7	μs	0.5	7$^+$#	12	11Ru.A	ET	2009	IT=100	*
^{92}Zr	−88459.02	0.09				STABLE			0$^+$	12			1924	IS=17.15 3	
^{92}Nb	−86453.3	1.8				34.7	My	2.4	7$^+$*	12			1938	β^+=100	*
^{92}Nb^m	−86317.8	1.8	135.5	0.4		10.116	d	0.013	(2)$^+$	12	19Kr13	T	1959	β^+=100	*
^{92}Nb^n	−86227.5	1.8	225.8	0.4		5.9	μs	0.2	(2)$^-$	12			1958	IT=100	
^{92}Nb^p	−84250.0	1.8	2203.3	0.4		167	ns	4	(11$^-$)	12			1989	IT=100	
^{92}Mo	−86808.59	0.16				STABLE		>190Ey	0$^+$	12	97Ba35	T	1930	IS=14.649 106;2β^+ ?	
^{92}Mo^m	−84048.07	0.21	2760.52	0.14		190	ns	3	8$^+$	12			1964	IT=100	*
^{92}Tc	−78926	3				4.25	m	0.15	(8)$^+$	12			1964	β^+=100	
^{92}Tc^m	−78656	3	270.09	0.08		1.03	μs	0.06	(4$^+$)	12	17Pa35	T	1976	IT=100	*
^{92}Tc^n	−78397	3	529.42	0.13		< 0.1	μs		(3$^+$)	12			1976	IT=100	
^{92}Tc^p	−78215	3	711.33	0.15		< 0.1	μs		1$^+$	12			1976	IT=100	
^{92}Ru	−74301.2	2.7				3.65	m	0.05	0$^+$	12			1971	β^+=100	
^{92}Ru^m	−71467	3	2833.9	1.8		100	ns	8	(8$^+$)	12	19Ha26	T	1980	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{92}Rh	−62999	4			5.61	s	0.08	(6$^+$)	12	19Pa16	TD	1994	β^+=100;β^+p=2.05 7	*
^{92}Rh^m	−62950#	100#	50#	100#	3.18	s	0.22	(2$^+$)	12	19Pa16	TD	2004	β^+=100;β^+p=1.7 3	*
^{92}Rh^n	−62890#	100#	105#	100#	232	ns	15	(4$^+$)		17Pa35	ETJ	2017	IT=100	*
^{92}Pd	−54780	350			1.06	s	0.03	0$^+$	12	19Pa16	TD	1994	β^+=100;β^+p=1.6 2	
^{92}Ag	−37530#	400#			1#	ms	>400ns		16	16Ce02	I	2016	β^+ ?; p ?	
*^{92}Se^m	T : other 12Ka36=10.3(+5.5-2.8)													**
*^{92}Se^m	E : uncertainty estimated by NuBase													**
*^{92}Br^m	T : symmetrized from 12Ka36=89(+7-8)													**
*^{92}Br^m	E : uncertainty estimated by NuBase													**
*^{92}Br^n	T : symmetrized from 12Ka36=84(+10-9)													**
*^{92}Br^n	E : uncertainty estimated by NuBase													**
*^{92}Rb	J : also 81Th04=0													**
*^{92}Sr	T : other (recent) 19Kr10=2.66(0.06)													**
*^{92}Y	J : 07Ch07=2													**
*^{92}Y^m	T : average 11Ru.A=3.3(0.6) 09Fo05=4.2(+0.8-0.6)													**
*^{92}Y^m	E : observed 315-keV and 419-keV gamma rays in a cascade; low energy													**
*^{92}Y^m	E : transition may directly depopulate the isomer													**
*^{92}Nb	J : 09Ch25=7													**
*^{92}Nb^m	T : average 19Kr13=10.07(0.02) 68Re04=10.14(0.03) 62Bu16=10.16(0.03)													**
*^{92}Nb^m	T : 59We30=10.15(0.03)													**
*^{92}Mo^m	T : other 17Pa35=200(37)													**
*^{92}Tc^m	T : average 17Pa35=1.02(0.17) 71Ho27=1.03(0.07)													**
*^{92}Ru^m	T : average 19Ha26=100(10) 80No06=100(14)													**
*^{92}Rh	D : %β^+p average 19Pa16=2.2(0.1) 12Lo08=1.9(0.1)													**
*^{92}Rh	J : from 97Ka07; 01Xu05>4													**
*^{92}Rh^m	T : also 04De40=0.53(0.37)													**
*^{92}Rh^n	E : 55.3(0.3) keV above the (2+) isomer													**
*^{92}Rh^n	T : from 19Ha26=232(15); other 17Pa35=230(60)													**
^{93}Se	−40860#	400#			130#	ms	>300ns	1/2$^+$#	11	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{93}Se^m	−40180#	400#	678.2	0.7	420	ns	100			12Ka36	ET	2012	IT=100	*
^{93}Br	−52890	430			152	ms	8	5/2$^-$#	11	13Mi13	TD	1981	β^-=100;β^-n=64 6;β^-2n ?	*
^{93}Kr	−64136.0	2.5			1.287	s	0.010	1/2$^+$*	11	13Mi13	TD	1951	β^-=100;β^-n=1.95 11	*
^{93}Rb	−72620	8			5.84	s	0.02	5/2$^-$*	11			1960	β^-=100;β^-n=1.39 7	
^{93}Rb^m	−68197	8	4423.1	1.5	111	ns	11	(27/2$^-$)	11			2010	IT=100	
^{93}Sr	−80086	8			7.43	m	0.03	5/2$^+$*	11			1959	β^-=100	*
^{93}Y	−84227	10			10.18	h	0.08	1/2$^-$*	11			1948	β^-=100	*
^{93}Y^m	−83468	10	758.719	0.021	820	ms	40	9/2$^+$*	11			1974	IT=100	*
^{93}Zr	−87122.0	0.5			1.61	My	0.05	5/2$^+$	11			1950	β^-=100	
^{93}Nb	−87212.8	1.5			STABLE			9/2$^+$*	11			1932	IS=100	*
^{93}Nb^m	−87182.0	1.5	30.760	0.005	16.12	y	0.12	1/2$^-$	11	20Ho10	E	1965	IT=100	
^{93}Nb^n	−79753	17	7460	17	1.5	μs	0.5	33/2$^-$#	11			2007	IT=100	*
^{93}Mo	−86807.08	0.18			4.0	ky	0.8	5/2$^+$	11			1946	ε=100	
^{93}Mo^m	−84382.13	0.18	2424.95	0.04	6.85	h	0.07	21/2$^+$	11			1950	IT=99.88 1;β^+=0.12 1	
^{93}Mo^n	−77112	17	9695	17	1.8	μs	1.0	(39/2$^-$)	11	05Fu01	T	2005	IT=100	*
^{93}Tc	−83606.1	1.0			2.75	h	0.05	9/2$^+$	11			1948	β^+=100	
^{93}Tc^m	−83214.3	1.0	391.84	0.08	43.5	m	1.0	1/2$^-$	11			1939	IT=77.4 6;β^+=22.6 6	
^{93}Tc^n	−81420.9	1.0	2185.16	0.15	10.2	μs	0.3	(17/2)$^-$	11			1973	IT=100	*
^{93}Ru	−77216.7	2.1			59.7	s	0.6	(9/2)$^+$	11			1972	β^+=100	
^{93}Ru^m	−76482.3	2.1	734.40	0.10	10.8	s	0.3	(1/2)$^-$	11			1983	β^+=78.0 23;IT=22.0 23; β^+p=0.027 5	
^{93}Ru^n	−75134.2	2.3	2082.5	0.9	2.30	μs	0.07	(21/2)$^+$	11	17Pa35	T	1983	IT=100	*
^{93}Rh	−69011.8	2.6			13.9	s	1.6	9/2$^+$#	11			1994	β^+=100	
^{93}Pd	−58980	370			1.17	s	0.02	(9/2$^+$)	11	19Pa16	TD	1994	β^+=100;β^+p=7.4 2	
^{93}Ag	−46400#	400#			228	ns	16	9/2$^+$#	16	16Ce02	T	1994	p=?;β^+ ?;β^+p ?	*
*^{93}Se^m	E : 12Ka36=208.3(0.5) and 469.9(0.5) gamma rays in cascade to gs													**
*^{93}Se^m	T : symmetrized from 12Ka36=390(+120-80)													**
*^{93}Br	D : %β^-n average 13Mi13=53(+11-8) 01Lh01=68(7)													**
*^{93}Kr	T : average 13Mi13=1.298(0.054) 12Qu01=1.245(0.070 stat)(0.030syst)													**
*^{93}Kr	T : 76Ru01=1.33(0.05) 75As04=1.27(0.02) 69Ca03=1.289(0.012)													**
*^{93}Kr	J : 95Ke04=1/2													**
*^{93}Kr	D : %β^-n other (recent) 13Mi13=1.9(+0.6-0.2)													**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{93}Sr J : 90Li28=5/2 **
*^{93}Y J : 07Ch07=1/2 **
*^{93}Y^m J : 07Ch07=9/2 **
*^{93}Nb J : also 09Ch25=9/2 **
*^{93}Nb^n E : from 7435.3(2.1)+x keV in Ensdf2011; x<50 keV assumed in Nubase **
*^{93}Nb^n J : week population (non-yrast) in 07Wa45, feeding the 7435.3 keV 37/2- **
*^{93}Nb^n J : level; given the Weisskopf T1/2 estimates and the measured T1/2, **
*^{93}Nb^n J : the depopulating 50 keV gamma transition is most likely E2 **
*^{93}Mo^n E : from 9670.0(2.3)+x keV in Ensdf2011; x<50 keV assumed in Nubase **
*^{93}Mo^n T : symmetrized from 05Fu01=1.1(+1.5-0.4) **
*^{93}Tc^n T : also 19Ha26=10(1) **
*^{93}Ru^n T : average 17Pa35=2.36(0.12) 09Ga40=2.7(0.2) 83Gr33=2.6(0.3) **
*^{93}Ru^n T : 83Ko07=2.6(0.2) 78Br25=2.05(0.10) **
*^{93}Ag T : estimated from the time of flight and the assumption that the ratio **
*^{93}Ag T : between the number of identified nuclei with the same Tz is identical **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{94}Se	−36800#	500#				50# ms >300ns	0^+	06	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	*
^{94}Se^m	−34370#	500#	2430.0	0.6		680 ns 50	(7^-)		20Li05	EJT	2020	IT=100	*
^{94}Br	−47650#	200#				70 ms 20	2^-#	06			1981	β^-=100;β^-n=68 16;β^-2n ?	
^{94}Br^m	−47360#	200#	294.6	0.5		530 ns 15			12Ka36	ET	2012	IT=100	
^{94}Kr	−61348	12				212 ms 4	0^+	11	16Mi18	T	1972	β^-=100;β^-n=1.11 7	*
^{94}Rb	−68562.8	2.0				2.702 s 0.005	3^-*	11	11Go37	D	1961	β^-=100;β^-n=10.3 3	*
^{94}Rb^m	−68458.6	2.0	104.2	0.2		130 ns 15	(0^-)		16Mi18	ETJ	2016	IT=100	
^{94}Rb^n	−66487.9	2.4	2074.9	1.4		107 ns 16	(10^-)	11			2008	IT=100	
^{94}Sr	−78845.7	1.7				75.3 s 0.2	0^+	11			1959	β^-=100	
^{94}Y	−82351	6				18.7 m 0.1	2^-*	06			1948	β^-=100	*
^{94}Y^m	−81149	6	1202.3	1.0		1.304 μs 0.012	(5^+)	06	17Ki09	T	1999	IT=100	*
^{94}Zr	−87269.33	0.16				STABLE >110Py	0^+	06	99Ar25	T	1924	IS=17.38 4;2β^- ?	
^{94}Nb	−86369.1	1.5				20.4 ky 0.4	6^+	06	12He11	T	1938	β^-=100	
^{94}Nb^m	−86328.2	1.5	40.892	0.012		6.263 m 0.004	3^+	06			1962	IT=99.50 6;β^-=0.50 6	
^{94}Mo	−88414.08	0.14				STABLE	0^+	06			1930	IS=9.187 33	
^{94}Tc	−84158	4				293 m 1	7^+*	06			1948	β^+=100	
^{94}Tc^m	−84082	5	76	3		52 m 1	$(2)^+$	06	68Ar06	D	1948	$\beta^+\approx$100;IT<0.18	
^{94}Ru	−82584	3				51.8 m 0.6	0^+	06			1952	β^+=100	
^{94}Ru^m	−79940	3	2644.1	0.4		67.5 μs 2.8	8^+	06	19Ha26	T	1971	IT=100	*
^{94}Rh	−72908	3			*	70.6 s 0.6	(4^+)	06	06Ba55	J	1979	β^+=100;β^+p=1.8 5	
^{94}Rh^m	−72853	3	54.60	0.20		480 ns 30	(2^+)	06			2004	IT=100	
^{94}Rh^n	−72610#	200#	300#	200#	*	25.8 s 0.2	(8^+)	06			1973	β^+=100	
^{94}Pd	−66102	4				9.1 s 0.3	0^+	06	19Pa16	TD	1982	β^+=100;β^+p<0.13	*
^{94}Pd^m	−61219	4	4883.1	0.4		515 ns 1	(14^+)	06	19Ha26	T	1995	IT=100	*
^{94}Pd^n	−58892	4	7209.8	0.8		206 ns 18	(19^-)		11Br01	TJ	2011	IT=100	*
^{94}Ag	−52400#	400#				27 ms 2	0^+#	06	19Pa16	TD	1994	β^+=100;β^+p<0.2	
^{94}Ag^m	−51050#	570#	1350#	400#		470 ms 10	(7^+)	06	19Pa16	TD	1994	β^+=100;β^+p=17.0 6	
^{94}Ag^n	−45900	370	6500#	550#		400 ms 40	(21^+)	06			2002	β^+=95.4 7;β^+p$\approx$27;p=4.1 6; 2p=0.5 3	*
^{94}Cd	−40440#	500#				80# ms >760ns	0^+	16	16Ce02	I	2016	β^+ ?;β^+p ?	

*^{94}Se I : 97Be70>300ns 95Cz.A>300ns 17Ch18 observed excited states **
*^{94}Se^m E : uncertainty of 0.3 keV is assumed for all gamma rays in the cascade **
*^{94}Kr T : average 16Mi18,13Mi13=227(14) 03Be05=212(5) 72Am01=200(10) **
*^{94}Kr T : 75As04=220(20); other (not used) 96Me09=330(100) **
*^{94}Rb J : also 81Th04=3 **
*^{94}Y J : 07Ch07=2 **
*^{94}Y^m T : average 17Ki09=1.33(0.01) 11Ru.A=1.295(0.005) 99Ge02=1.35(0.02); **
*^{94}Y^m T : Birge ratio=2.77 **
*^{94}Ru^m T : average 19Ha26=64(4) 71Le19=71(4); other 17Ze02=102(17) for q=44+ **
*^{94}Ru^m T : (bare ion); 77Ha49=68(10) **
*^{94}Pd T : average 19Pa16=9.1(0.4) 82Ku15=9.0(0.5) **
*^{94}Pd^m T : average 19Ha26=515(1) 17Pa35=495(7) 11Br01=499(13) 09Ga40=468(19) **
*^{94}Pd^m T : 02La18=530(10), same as 98Gr.B=530(10) and supersedes 97Gr02=600(100); **
*^{94}Pd^m T : other 95Go30=800(200) **
*^{94}Pd^n E : from a least-squares fit to Eg **
*^{94}Pd^n T : average 17Pa35=225(32) 11Br01=197(22) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{94}Ag^n D : %p=1.9(5) + 2.2(4) from 05Mu15, %2p from 06Mu03 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{95}Se	−30460#	500#				70#	ms	>400ns	3/2$^+$#	12	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{95}Br	−43850#	300#				80#	ms	>300ns	5/2$^-$#	10	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{95}Br^m	−43310#	300#	537.9	0.5		6.8	μs	1.0			12Ka36	ET	2012	IT=100	*
^{95}Kr	−56159	19				114	ms	3	1/2$^+$*	10	95Ke04	J	1994	β^-=100;β^-n=2.87 18; β^-2n ?	
^{95}Kr^m	−55964	19	195.5	0.3		1.582	μs	0.022	(7/2$^+$)	10	12Ka36	T	2006	IT=100	*
^{95}Rb	−65890	20				377.7	ms	0.8	5/2$^-$*	10			1967	β^-=100;β^-n=8.7 3	*
^{95}Rb^m	−65055	20	835.0	0.6		< 500	ns		9/2$^+$#	10			2009	IT=100	
^{95}Sr	−75117	6				23.90	s	0.14	1/2$^+$*	10			1961	β^-=100	*
^{95}Y	−81208	7				10.3	m	0.1	1/2$^-$*	10			1959	β^-=100	*
^{95}Y^m	−80120	7	1087.6	0.6		48.6	μs	0.5	9/2$^+$	10	11Ru.A	T	1981	IT=100	
^{95}Zr	−85659.9	0.9				64.032	d	0.006	5/2$^+$	10			1946	β^-=100	
^{95}Nb	−86786.3	0.5				34.991	d	0.006	9/2$^+$	10			1951	β^-=100	
^{95}Nb^m	−86550.6	0.5	235.69	0.02		3.61	d	0.03	1/2$^-$	10			1969	IT=94.4 6;β^-=5.6 6	
^{95}Mo	−87711.87	0.12				STABLE			5/2$^+$*	10			1930	IS=15.873 30	
^{95}Tc	−86021	5				19.258	h	0.026	9/2$^+$*	10	20Sz02	T	1947	β^+=100	
^{95}Tc^m	−85982	5	38.91	0.04		61.96	d	0.24	1/2$^-$	10	20Sz02	T	1959	β^+=96.1 3;IT=3.9 3	
^{95}Ru	−83458	10				1.607	h	0.004	5/2$^+$	10	20Sz02	T	1948	β^+=100	*
^{95}Rh	−78341	4				5.02	m	0.10	(9/2)$^+$	10			1967	β^+=100	
^{95}Rh^m	−77798	4	543.3	0.3		1.96	m	0.04	(1/2)$^-$	10			1974	IT=88 5;β^+=12 5	
^{95}Pd	−69966	3				7.4	s	0.4	9/2$^+$#	10	19Pa16	TD	1980	β^+=100;β^+p=0.23 5	*
^{95}Pd^m	−68091	3	1875.13	0.14		13.3	s	0.2	(21/2$^+$)	10	19Pa16	TD	1982	β^+=89 3;IT=11 3; β^+p=0.71 7	*
^{95}Ag	−59910#	400#				1.78	s	0.06	(9/2$^+$)	10	19Pa16	TD	1994	β^+=100;β^+p=2.3 2	*
^{95}Ag^m	−59570#	400#	344.2	0.3		< 500	ms		(1/2$^-$)	10			2003	IT=100	
^{95}Ag^n	−57380#	400#	2531.3	1.5		< 16	ms		(23/2$^+$)	10			2003	IT=100	
^{95}Ag^p	−55050#	400#	4860.0	1.5		< 40	ms		(37/2$^+$)	10			2003	IT=100	
^{95}Cd	−47060#	570#				32	ms	3	9/2$^+$#		18Pa20	TD	2011	β^+=100;β^+p=4.6 11	*

*^{95}Br^m T : symmetrized from 12Ka36=6.7(+1.1-0.9) **
*^{95}Kr^m T : others 11Ru.A=1.28(0.05) 06Ge05=1.4(0.2) **
*^{95}Rb J : also 81Th04=5/2 **
*^{95}Sr J : 90Li28=1/2 **
*^{95}Y J : 07Ch07=1/2 **
*^{95}Ru T : average 20Sz02=1.6033(0.0044) 70Bo22=1.632(0.021) 68Pi03=1.650(0.017) **
*^{95}Pd T : average 19Pa16=7.4(0.5) 12Lo08=7.5(0.5) **
*^{95}Pd^m T : average 19Pa16=13.2(0.4) 82Ku15=13.3(0.3) **
*^{95}Pd^m D : IT from 82Ku15=11(3)% **
*^{95}Ag T : average 19Pa16=1.80(0.07) 12Lo08=1.76(0.09) **
*^{95}Ag D : %β^+p average 19Pa16=2.1(0.3)% 12Lo08=2.5(0.3)% **
*^{95}Cd T : others 17Da07=29(8) 10St.A=73(+53-28) **
*^{95}Cd D : %β^+p symmetrized from 18Pa20=4.5(+1.2-1.0) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{96}Br	−38210#	300#				20#	ms	>300ns		08	97Be70	I	1997	β^- ?;β^-n ?;β^-2n ?	
^{96}Br^m	−37900#	300#	311.5	0.5		3.0	μs	0.9			12Ka36	ET	2012	IT=100	*
^{96}Kr	−53082	19				80	ms	8	0$^+$	12			1994	β^-=100;β^-n=3.7 4	
^{96}Rb	−61354	3			*	201.5	ms	0.9	2$^-$*	08	93Ru01	TD	1967	β^-=100;β^-n=13.7 5;β^-2n ?	*
^{96}Rb^m	−61350#	200#	0#	200#	*	200#	ms	>1ms	1(+#)		81Bo30	JI	1981	β^- ?;IT ?;β^-n ?;β^-2n ?	*
^{96}Rb^n	−60219	3	1134.6	1.1		1.80	μs	0.04	(10$^-$)	08			1999	IT=100	*
^{96}Sr	−72918	8				1.059	s	.008	0$^+$	08	12Qu01	T	1971	β^-=100;β^-n ?	*
^{96}Y	−78330	6				5.34	s	0.05	0$^-$*	08			1975	β^-=100	*
^{96}Y^m	−76790	6	1540	9	MD	9.6	s	0.2	8$^+$*	08			1974	β^-=100	*
^{96}Y^n	−76675	6	1655.0	1.1		181	ns	9	(6$^+$)		20Is08	EJT	2017	IT=100	
^{96}Zr	−85438.86	0.11				23.4	Ey	1.7	0$^+$	08	18Ma51	T	1934	IS=2.80 2;2β^-=100	*
^{96}Nb	−85602.83	0.15				23.35	h	0.05	6$^+$	08			1949	β^-=100	
^{96}Mo	−88794.89	0.12				STABLE			0$^+$	08			1930	IS=16.673 8	
^{96}Tc	−85822	5				4.28	d	0.07	7$^+$*	08			1947	β^+=100	
^{96}Tc^m	−85788	5	34.23	0.04		51.5	m	1.0	4$^+$	08			1950	IT=98.0 5;β^+=2.0 5	
^{96}Ru	−86080.39	0.17				STABLE		>80Ey	0$^+$	08	13Be09	T	1931	IS=5.54 14;2β^+ ?	*
^{96}Rh	−79688	10				9.90	m	0.10	6$^+$	08			1967	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{96}Rh^{m}	−79636	10	51.98	0.09		1.51	m	0.02	3^{+}	08			1966	IT=60 5;β^{+}=40 5	
^{96}Pd	−76183	4				122	s	2	0^{+}	08			1980	β^{+}=100	
^{96}Pd^{m}	−73652	4	2530.57	0.23		1.804	μs	0.007	8^{+}#	08	17Pa35	T	1983	IT=100	*
^{96}Ag	−64510	90			*	4.45	s	0.03	$(8)^{+}$	08	19Pa16	TD	1982	β^{+}=100;β^{+}p=4.2 4	*
^{96}Ag^{m}	−64510#	100#	0#	50#	*	6.9	s	0.5	(2^{+})	08	12Lo08	TD	2003	β^{+}=100;β^{+}p=14.9 18	*
^{96}Ag^{n}	−62050	90	2461.4	0.3		103.2	μs	4.5	(13^{-})		11Bo23	TJD	2011	IT=100	*
^{96}Ag^{p}	−61820	90	2686.7	0.4		1.561	μs	0.016	(15^{+})	08	17Pa35	ETJ	2011	IT=100	*
^{96}Ag^{q}	−57560	90	6951.8	1.4		132	ns	17	(19^{+})		17Pa35	ETJ	2011	IT=100	*
^{96}Cd	−55570#	410#				1003	ms	47	0^{+}	10	19Pa16	TD	2008	β^{+}=100;β^{+}p=1.6 3	*
^{96}Cd^{m}	−49540#	1450#	6030	1390		511	ms	26	16^{+}	10	19Pa16	ETD	2011	β^{+}=100;β^{+}p=15.4 21	*
^{96}Cd^{n}	−49970#	410#	5605	5		198	ns	18	$(12^{-},13^{-})$		19Da02	EJ	2019	IT=100	*
^{96}In	−38090#	500#				1#	ms	>400ns		16	16Ce02	I	2016	β^{+} ?; p ?	

*^{96}Br^{m} T : symmetrized from 12Ka36=2.7(+1.1-0.7) **
*^{96}Rb J : 81Th04=2 **
*^{96}Rb D : %β^{-}n average 93Ru01=14.7(1.0) 81Ho07=14.7(1.2) 81En05=14.2(1.2) **
*^{96}Rb D : 79Ri09=12.5(0.9) 69Am01=12.7(1.5) **
*^{96}Rb T : average 12Qu01=212(17) 03Be05=197(6) 93Ru01=201(1) 79Ri09=197(5) **
*^{96}Rb T : 78Wo09=203(4) 77Re05=205(4) 74Ro15=199(3.5) 71Tr02=207(3) **
*^{96}Rb^{m} I : non-observation in 81Th04 is not in contradiction with 81Bo30 **
*^{96}Rb^{n} T : average 12Ka36=1.72(+0.16-0.14) 11Ru.A=1.77(0.05) 05Pi13=2.0(0.1) **
*^{96}Rb^{n} T : 99Ge01=1.65(0.15) **
*^{96}Sr T : average 12Qu01=0.950(0.035) 90Ma03=1.07(0.01) 79En02=1.10(0.02) **
*^{96}Sr T : 78Wo09=1.015(0.019) 75Ba36=1.06(0.04) **
*^{96}Y J : 07Ch07=0 **
*^{96}Y^{m} J : 07Ch07=8 **
*^{96}Zr T : 2ν-$\beta\beta$ average 18Ma51=20.3(+4.6-0.31) 10Ar07=23.5(1.4,stat)(1.6,syst) **
*^{96}Zr T : 99Ar25=21(+8-4,stat + 2,syst); others 93Ka12=39(9) and 01Wi17=9.4(3.2) **
*^{96}Zr T : in geochemical exp., 16Fi01>24Ey; 20Ba.A,15Ba11=23(2) (evaluation) **
*^{96}Ru T : 2nu-$\beta^{+}\varepsilon$>80 Ey (theor. most probable); 2nu$\beta^{+}\beta^{+}$>140 Ey 0nu2K>1 Zy **
*^{96}Pd^{m} T : average 17Pa35=1.80(0.01) 98Gr.B=1.81(0.01), supersedes 97Gr02=1.7(0.1), **
*^{96}Pd^{m} T : 09Ga40=1.76(0.05); others 07My02=2.10(0.21) 83Gr01=2.2(0.3) **
*^{96}Ag T : average 19Pa16=4.46(0.04) 03Ba39=4.40(0.06) 97Sc30=4.50(0.06) **
*^{96}Ag D : %β^{+}p average 19Pa16=4.4(0.5) 96He25=3.7(0.9) **
*^{96}Ag^{m} T : average 12Lo08=6.8(1.0) 03Ba39=6.9(0.6) **
*^{96}Ag^{m} D : %β^{+}p average 19Pa16=14.7(2.4) 12Lo08=14(3) 03Ba39=18(5) **
*^{96}Ag^{n} E : from a least-squares fit to Eg using 11Bo23 level scheme **
*^{96}Ag^{n} T : average 19Ha26=104(5) 11Bo23=100(10) **
*^{96}Ag^{p} E : 43.7(0.2) keV above the 2643(0.3) keV, 13+ level **
*^{96}Ag^{p} T : average 17Pa35=1.57(0.02) 11Bo23=1.56(0.03) 11Be34=1.45(0.07) **
*^{96}Ag^{q} E : 4265(2) keV above 96Agp **
*^{96}Ag^{q} T : average 19Ha26=120(20), supersedes 17Pa35=160(41), 11Bo23=160(30) **
*^{96}Cd T : average 19Pa16=1020(60) 17Da07=970(90) 10St.A=990(130) **
*^{96}Cd D : %β^{+}p average 19Pa16=1.7(0.4) 17Da07=1.5(0.5) **
*^{96}Cd^{m} E : symmetried from 5810(+1560-1220) keV **
*^{96}Cd^{m} T : average 19Pa16=530(30) 17Da07=450(+50-40); other 11Na34=290(+110-100) **
*^{96}Cd^{m} D : %β^{+}p average 19Pa16=19.5(2.9) 17Da07=11(3) **
*^{96}Cd^{n} T : symmetrized from 19Da02=197(+19-17) **
*^{96}Cd^{n} E : uncertainty of 1 keV is assumed for all gamma rays in the cascade **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{97}Br	−34000#	400#				40#	ms	>300ns	$5/2^{-}$#	10			1997	β^{-} ?;β^{-}n ?;β^{-}2n ?	
^{97}Kr	−47420	130				62.2	ms	3.2	$3/2^{+}$#	10	11Ni01	T	1997	β^{-}=100;β^{-}n=6.7 6;β^{-}2n ?	*
^{97}Rb	−58519.1	1.9				169.1	ms	0.6	$3/2^{+}$*	15			1969	β^{-}=100;β^{-}n=25.5 9;β^{-}2n ?	
^{97}Rb^{m}	−58442.5	1.9	76.6	0.2		5.7	μs	0.6	$(1/2,3/2)^{-}$	15			2012	IT=100	
^{97}Sr	−68581	3				432	ms	4	$1/2^{+}$*	10	02Pf04	D	1978	β^{-}=100;β^{-}n=0.02 1	*
^{97}Sr^{m}	−68273	3	308.13	0.11		175.2	ns	2.1	$7/2^{+}$	10	19Es04	T	1990	IT=100	*
^{97}Sr^{n}	−67750	3	830.83	0.23		513	ns	5	$(9/2^{+})$	10	19Es04	T	1974	IT=100	*
^{97}Y	−76115	7				3.75	s	0.03	$1/2^{-}$*	10			1970	β^{-}=100;β^{-}n=0.055 4	*
^{97}Y^{m}	−75447	7	667.52	0.23		1.17	s	0.03	$9/2^{+}$*	10	83Re10	D	1970	β^{-}>99.3;IT<0.7; β^{-}n=0.11 3	*
^{97}Y^{n}	−72592	7	3522.6	0.4		142	ms	8	$(27/2^{-})$*	10			1986	IT=94.8 9;β^{-}=5.2 9	*
^{97}Zr	−82936.69	0.12				16.749	h	0.008	$1/2^{+}$*	10			1951	β^{-}=100	*
^{97}Zr^{m}	−81672.34	0.20	1264.35	0.16		104.8	ns	1.7	$7/2^{+}$	10	11Ru.A	T	1976	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{97}Nb	−85603	4				72.1 m	0.7	$9/2^+$	10			1951	β^-=100	
^{97}Nb^m	−84860	4	743.35	0.03		58.7 s	1.8	$1/2^-$	10			1950	IT=100	
^{97}Mo	−87544.70	0.16				STABLE		$5/2^+$*	10			1930	IS=9.582 15	
^{97}Tc	−87224	4				4.21 My	0.16	$9/2^+$*	10	20Kr09	J	1946	ε=100	*
^{97}Tc^m	−87127	4	96.57	0.06		91.1 d	0.6	$1/2^-$	10	98Ko27	DT	1954	IT=96.06 18;ε=3.94 18	*
^{97}Ru	−86120.6	2.8				2.8370 d	0.0014	$5/2^+$	10	09Go29	T	1946	β^+=100	
^{97}Rh	−82600	40				30.7 m	0.6	$9/2^+$	10			1955	β^+=100	
^{97}Rh^m	−82340	40	258.76	0.18		46.2 m	1.6	$1/2^-$	10			1971	β^+=94.4 6;IT=5.6 6	
^{97}Pd	−77806	5				3.10 m	0.09	$5/2^+$#	10			1969	β^+=100	
^{97}Ag	−70904	12				25.5 s	0.3	$(9/2)^+$*	10			1978	β^+=100	*
^{97}Ag^m	−70290	40	620	40	MD	100# ms		$1/2^-$#		20Ho03	E	2019	IT ?	
^{97}Cd	−60730	420				1.16 s	0.05	$(9/2^+)$	10	19Pa16	TD	1978	β^+=100;β^+p=7.4 2	*
^{97}Cd^m	−59480	420	1245.1	0.2		730 μs	70	$(1/2^-)$		19Pa16	ETD	2019	IT=100	
^{97}Cd^n	−58110	720	2620	580		3.86 s	0.06	$(25/2^+)$	10	19Pa16	ETD	1982	β^+=100;β^+p=25.1 5	*
^{97}In	−47390#	400#				36 ms	6	$9/2^+$#		18Pa20	TD	2011	β^+=100;β^+p=2.3 13;p ?	*
^{97}In^m	−46990#	410#	400#	100#		0.12 ms	0.07	$1/2^-$#	20	18Pa20	TD	2018	p ?	*

*^{97}Kr T : average 11Ni01=60(+6-5) 03Be05=63(4) **
*^{97}Sr J : 90Li28=1/2 **
*^{97}Sr T : average 12Qu01=456(5,stat)(13,syst) 86Wa17=429(5) 87PfZX=420(20) **
*^{97}Sr T : 82Ga24=420(40) 78Wo09=441(15); others (not used) 81En05=390(30) **
*^{97}Sr T : 83Re10=403(4), superseded by 86Wa17 79En02=430(30), superseded by **
*^{97}Sr T : 81En05 **
*^{97}Sr^m T : average 19Es04=174.7(6.9) 15Cz01=165(4) 11Ru.A=180.9(2.8) 06Hw01=165(25) **
*^{97}Sr^m T : 83Kr11=170(10) **
*^{97}Sr^n T : average 19Es04=526(17) 18Rz01=504(8) 13Ru07=515(10) 05Zl01=526(13); **
*^{97}Sr^n T : others (not used) 12Ka36=520(+160-120) 80Mo.A=515(15) 06Hw01=255(56) **
*^{97}Sr^n T : 03Hw03=265(27), non standard technique and conflicting **
*^{97}Y J : 07Ch07=1/2 **
*^{97}Y^m J : 07Ch07=9/2 **
*^{97}Y^m D : %β^-n from 83Re10=0.11(0.03); other 86Wa17<0.08 **
*^{97}Y^n J : 07Ch07=(27/2) **
*^{97}Zr J : 02Ca37=1/2 **
*^{97}Zr^m T : average 11Ru.A=106.1(2.1) 85Be20=102(3); others outweighed 06Hw01=97(16) **
*^{97}Zr^m T : 96Lh03=106(7) **
*^{97}Tc T : from 98Ko27 **
*^{97}Tc^m T : average 98Ko27=91.4(0.8), supersedes 93Ko64=92.2(1.8), 54Bo24=90.5(1.0) **
*^{97}Ag J : 14Fe01=(9/2) **
*^{97}Cd T : average 19Pa16=1.20(0.07) 11Lo09=1.10(0.08) **
*^{97}Cd D : other %β^+p 11Lo09=11.8(20) **
*^{97}Cd^n J : 11Lo09=(25/2+) **
*^{97}In T : other 10St.A=26(+47-10) **
*^{97}In D : %β^+p symmetrized from 18Pa20=1.7(+1.7-0.8) **
*^{97}In^m T : from 1.3<T<230 us in 18Pa20 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{98}Br	−28050#	400#				15# ms	>400ns		20	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{98}Kr	−44120#	300#				42.8 ms	3.6	0^+	20	11Ni01	T	1997	β^-=100;β^-n=7.0 10;β^-2n ?	*
^{98}Rb	−54369	16				115 ms	6	(0^-)*	20			1971	β^-=100;β^-n=14.3 9; β^-2n=0.054 8	
^{98}Rb^m	−54296	20	73	26	BD	96 ms	3	(3^+)*	20			1980	β^-=100;β^-n ?;β^-2n ?	
^{98}Rb^n	−54191	16	178.5	0.4		358 ns	7	(2^-)	20	FGK205	J	2009	IT=100	*
^{98}Sr	−66422	3				653 ms	2	0^+	20			1971	β^-=100;β^-n=0.23 3	
^{98}Y	−72289	8				548 ms	2	0^-*	20			1970	β^-=100;β^-n=0.33 3	*
^{98}Y^m	−72118	8	170.78	0.05		615 ns	8	2^-	20			1972	IT=100	*
^{98}Y^n	−71823	8	465.7	0.7	MD	2.32 s	0.08	$(6,7)^+$	20	17Ur03	JED	1977	$\beta^-\approx$100;IT ?;β^-n=3.44 95	*
^{98}Y^p	−71793	8	496.10	0.11		6.90 μs	0.054	$(4)^-$	20			1970	IT=100	*
^{98}Y^q	−71695	13	594	10		180 ns	7	$(3^-,4^-)$				2017	IT=100	*
^{98}Y^r	−71317	8	972.17	0.20		450 ns	150	(8^+)	20			2017	IT=100	
^{98}Y^x	−71108	8	1181.50	0.18		762 ns	14	(10^-)	20			1972	IT=100	*
^{98}Zr	−81282	8				30.7 s	0.4	0^+	20			1967	β^-=100	
^{98}Zr^m	−74680	8	6601.9	1.1		1.9 μs	0.2	(17^-)	20			2005	IT=100	
^{98}Nb	−83525	5				2.86 s	0.06	1^+	20			1960	β^-=100	
^{98}Nb^m	−83441	6	84	4		51.1 m	0.4	$(5)^+$	20			1948	$\beta^-\approx$100;IT ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{98}Mo	−88115.98	0.17				STABLE >100Ty	0^+	20	52Fr23	T	1930	IS≈24.292 80;2β^- ?	*
^{98}Tc	−86432	3				4.2 My 0.3	6^+*	20	20Kr09	J	1955	β^-=100;β^+=0	
^{98}Tc^m	−86341	3	90.77	0.16		14.7 μs 0.5	$(2,3)^-$	20			1976	IT=100	
^{98}Ru	−88225	6				STABLE	0^+	20			1944	IS=1.87 3	
^{98}Rh	−83175	12			*	8.72 m 0.12	$(2)^+$	20			1955	β^+=100	
^{98}Rh^m	−83119	12	56.3	1.0	*	3.6 m 0.2	(5^+)	20			1966	IT=89 5;β^+=11 5	
^{98}Pd	−81321	5				17.7 m 0.4	0^+	20			1955	β^+=100	
^{98}Ag	−73070	30				47.5 s 0.3	$(6)^+$*	20			1978	β^+=100;β^+p=0.0012 5	*
^{98}Ag^m	−72960	30	107.28	0.10		161 ns 7	(4^+)	20			1998	IT=100	
^{98}Cd	−67640	50				9.29 s 0.10	0^+	20			1978	β^+=100;β^+p<0.029	*
^{98}Cd^m	−65210	50	2428.3	0.4		154 ns 16	(8^+)	20	17Pa35	T	1996	IT=100	
^{98}Cd^n	−61010	50	6635	2		224 ns 5	(12^+)	20			2004	IT=100	
^{98}In	−53910#	300#			*	30 ms 1	(0^+)	20			1994	β^+=100;β^+p≤0.13	
^{98}In^m	−53090#	790#	820	730	*	890 ms 20	(9^+)	20			2001	β^+=100;β^+p=44 2	

*^{98}Kr T : average 11Ni01=42(4) 03Be05=46(8) **
*^{98}Rb^n J : 178.5 keV gamma to (0-) and Weisskopf estimates for E1,M1 and E2 **
*^{98}Y J : 07Ch07=0 **
*^{98}Y^m T : average 17Ur03=640(20) 11Ru.A=610(9); other: 70Gr38=620(80) **
*^{98}Y^n J : other: 07Ch07=(4,5) hfs **
*^{98}Y^n D : %β^-n from 81En05 **
*^{98}Y^p T : average 17Ur03=6.95(0.06) 11Ru.At=6.87(0.05) **
*^{98}Y^q E : 564.0+x keV is proposed in 17Ur03; x=30(10) is estimated by Nubase **
*^{98}Y^x T : average 11Ru.At=806(21) 17Ur03=720(20) 70Gr38=830(100) **
*^{98}Mo T : 0nu-BB 52Fr23>100 Ty (theoretically faster, see text) **
*^{98}Ag D : %β^+p symmetrized from 96He25=0.0011(+5-4) **
*^{98}Ag J : 14Fe01=(5,6) **
*^{98}Cd T : average 92Pl01=9.2(0.3) 19Pa16=9.3 (0.1) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{99}Kr	−38400#	400#				40 ms 11	$5/2^-$#	17	03Be05	TD	1997	β^-=100;β^-n=11 7;β^-2n ?	*
^{99}Rb	−51121	4				54 ms 4	$(3/2^+)$	17	02Pf04	D	1971	β^-=100;β^-n=17.3 25; β^-2n ?	
^{99}Sr	−62519	5				269.2 ms 1.0	$3/2^+$*	17	93Ru01	D	1975	β^-=100;β^-n=0.100 19	*
^{99}Y	−70644	7				1.484 s 0.007	$5/2^+$*	17			1975	β^-=100;β^-n=1.77 19	
^{99}Y^m	−68502	7	2141.65	0.19		8.2 μs 0.4	$(17/2^+)$	17			1985	IT=100	*
^{99}Zr	−77617	10				2.1 s 0.1	$1/2^+$*	17			1970	β^-=100	*
^{99}Zr^m	−77365	10	251.96	0.09		336 ns 5	$7/2^+$	17	20Bo04	T	1970	IT=100	*
^{99}Nb	−82335	12				15.0 s 0.2	$9/2^+$*	17			1950	β^-=100	*
^{99}Nb^m	−81970	12	365.27	0.08		2.5 m 0.2	$1/2^-$	17			1960	β^-≈100;IT=?	
^{99}Mo	−85970.11	0.23				65.932 h 0.005	$1/2^+$*	17	FGK209	T	1948	β^-=100	*
^{99}Mo^m	−85872.33	0.23	97.785	0.003		15.5 μs 0.2	$5/2^+$	17			1958	IT=100	
^{99}Mo^n	−85286.01	0.30	684.10	0.19		760 ns 60	$11/2^-$	17			1975	IT=100	
^{99}Tc	−87327.9	0.9				211.1 ky 1.2	$9/2^+$*	17	20Kr09	J	1938	β^-=100	*
^{99}Tc^m	−87185.2	0.9	142.6836	0.0011		6.0066 h 0.0002	$1/2^-$*	17	FGK209	T	1958	IT≈100;β^-=0.0037 6	
^{99}Ru	−87625.4	0.3				STABLE	$5/2^+$*	17			1931	IS=12.76 14	*
^{99}Rh	−85585	19				16.1 d 0.2	$1/2^-$	17			1952	β^+=100	
^{99}Rh^m	−85521	19	64.4	0.5		4.7 h 0.1	$9/2^+$*	17			1952	β^+≈100;IT ?	
^{99}Pd	−82183	5				21.4 m 0.2	$(5/2)^+$	17			1955	β^+=100	
^{99}Ag	−76712	6				2.07 m 0.05	$(9/2)^+$*	17			1967	β^+=100	*
^{99}Ag^m	−76206	6	506.2	0.4		10.5 s 0.5	$(1/2)^-$*	17			1978	IT=100	*
^{99}Cd	−69931.1	1.6				17 s 1	$5/2^+$#	17	19Pa16	TD	1978	β^+=100;β^+p=0.21 2; $\beta^+\alpha$<1e-4	
^{99}In	−61380#	300#				3.11 s 0.06	$9/2^+$#	17	19Pa16	TD	1994	β^+=100;β^+p=0.29 3	
^{99}In^m	−60980#	340#	400#	150#		1# s	$1/2^-$#					β^+ ?;β^+p ?;IT ?	
^{99}Sn	−47980#	580#				24 ms 4	$9/2^+$#	17	18Pa20	TD	2011	β^+=100;β^+p=5 3	*

*^{99}Kr T : other 11Ni01=13(+34-6) **
*^{99}Sr J : 91Li05,90Li28=3/2 **
*^{99}Sr T : average 86ReZU=269(1) 83Re10=274(4) 83Wo10=266(6) **
*^{99}Y J : 07Ch07=5/2 **
*^{99}Y T : other (recent) 19Do02=1.27(0.25) **
*^{99}Y^m T : average 13RuZX=8.0(0.5) 85Me09=8.6(0.8); other: 99Ge01=11(2) **
*^{99}Zr J : 02Ca37=1/2 **
*^{99}Zr^m J : 130.2-keV gamma ray, E2 to 3/2+ **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

$*^{99}$Zr^m	T : other 04Hw02=316(48) 99Ge01=400(20) 79Se01=292(20) 70Gr38=400(80)	**
$*^{99}$Nb	J : 09Ch25=9/2	**
$*^{99}$Mo	J : 74Ru05=1/2	**
$*^{99}$Tc	J : 20Kr09,58Lo62=9/2	**
$*^{99}$Ru	J : 13Ma15=5/2	**
$*^{99}$Ag	J : 14Fe01=(9/2)	**
$*^{99}$Ag^m	J : 14Fe01=(1/2)	**
$*^{99}$Sn	D : %β^+p symmetrized from 18Pa20=3.9(+3.4-1.7)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{100}Kr	−34470#	400#					12	ms	8	0^+	11	11Ni01	TD	1997	β^-=100;β^-n ?;β^-2n ?	*
^{100}Rb	−46266	13					51.3	ms	1.6	4^-#	08	20Mu.A	T	1978	β^-=100;β^-n=5.6 12; β^-2n=0.15 5	*
^{100}Sr	−59818	7					202.1	ms	1.7	0^+	08	02Pf04	D	1978	β^-=100;β^-n=1.11 34	*
^{100}Sr^m	−58199	7	1618.72	0.20			122	ns	9	(4^-)		12Ka36	T	1995	IT=100	*
^{100}Y	−67321	11				&	940	ms	30	4^+*	08	10Ba31	J	1977	β^-=100;β^-n ?	*
^{100}Y^m	−67177	11	144	16	MD	&	727	ms	6	1^+#	08	93Ru01	D	1977	β^-=100;β^-n=1.08 6	*
^{100}Zr	−76373	8					7.1	s	0.4	0^+	08			1970	β^-=100	
^{100}Nb	−79791	8					1.5	s	0.2	1^+	08			1967	β^-=100	
^{100}Nb^m	−79478.5	2.0	313	8	MD		2.99	s	0.11	(5^+)	08			1967	β^-=100	
^{100}Nb^n	−79444	11	347	8			460	ns	60	$(4^-,5^-)$	08			1986	IT=100	*
^{100}Nb^p	−79057	11	734	8			12.43	μs	0.26	(8^-)	08	11Ru.A	T	1980	IT=100	*
^{100}Mo	−86193.0	0.3					7.07	Ey	0.14	0^+	08	20Ba.A	T	1930	IS=9.744 65;2β^-=100	*
^{100}Tc	−86021.0	1.4					15.46	s	0.19	1^+	08			1952	$\beta^-\approx$100;ε=0.0018 9	
^{100}Tc^m	−85820.3	1.4	200.67	0.04			8.32	μs	0.14	$(4)^+$	08			1958	IT=100	
^{100}Tc^n	−85777.1	1.4	243.95	0.04			3.2	μs	0.2	$(6)^+$	08			1967	IT=100	
^{100}Ru	−89227.4	0.3					STABLE			0^+	08			1931	IS=12.60 7	
^{100}Rh	−85591	18					20.8	h	0.1	1^-*	08			1948	β^+=100;ε=95.1 5; e$^+$=4.9 5	
^{100}Rh^m	−85516	18	74.782	0.014			214.0	ns	2.0	$(2)^+$	08			1965	IT=100	
^{100}Rh^n	−85483	18	107.6	0.2			4.6	m	0.2	(5^+)	08			1973	IT$\approx$98.3;$\beta^+\approx$1.7	
^{100}Rh^p	−85371	18	219.61	0.22			130	ns	10	(7^+)	08			1984	IT=100	
^{100}Pd	−85213	18					3.63	d	0.09	0^+	08			1948	ε=100	
^{100}Ag	−78138	5					2.01	m	0.09	$(5)^+*$	08			1970	β^+=100	*
^{100}Ag^m	−78122	5	15.52	0.16			2.24	m	0.13	$(2)^+$	08			1980	β^+=?;IT ?	
^{100}Cd	−74194.6	1.7					49.1	s	0.5	0^+	10			1970	β^+=100	
^{100}In	−64178.1	2.2					5.62	s	0.06	6^+#	14	19Pa16	TD	1982	β^+=100;β^+p=1.66 3	
^{100}Sn	−57150	240					1.18	s	0.08	0^+	14	19Lu08	T	1994	β^+=100;β^+p$<$17	*
^{100}Sn^m	−52650#	310#	4500#	200#			100#	ns		6^+#		11Hi.A	ETJ		p ?	

$*^{100}$Kr	T : symmetrized from 11Ni01=7(+11-3)	**
$*^{100}$Rb	T : average 20Mu.A=50(5) 11Ni01=48(3) 87PfZX=53(2)	**
$*^{100}$Rb	D : %β^-n from 93Ru01; %β^-2n from P2n/Pn=0.027 7 in 81JoZV and %β^-n	**
$*^{100}$Sr	T : average 11Ni01=181(+16-13) 93Ru01=165(24) 87PfZX=207(10) 86Wa17=204(2)	**
$*^{100}$Sr	T : 86Wo01=193(4) 83Mu19=214(8) 78Ko29=170(80) 85IaZZ=200(20)	**
$*^{100}$Sr^m	T : other 95Pf04=85(7)	**
$*^{100}$Y	J : 10Ba31=4+ and p5/2[422] n3/2[411], K=4+ configuration by the measured	**
$*^{100}$Y	J : magnetic moment; other 07Ch07=(3). Ensdf2008 assigns J=(3,4,5) and	**
$*^{100}$Y	J : associate this state with an excited isomer	**
$*^{100}$Y	T : from $\beta-\gamma$(t) in 77Kh03, where low- and high-spin β^- decaying	**
$*^{100}$Y	T : isomers were resolved; recent (from β(t)) 09Pe06=660(+150-120)	**
$*^{100}$Y	T : and 12Qu01=845(80,stat)(55,syst) include both gs and isomer	**
$*^{100}$Y^m	T : average 96Me09=710(30) 86Wo01=735(7) 83Mu14=682(18) 73Kh03=550(150)	**
$*^{100}$Y^m	T : from data dominated by the ^{100}Sr (J^π=0+) isobar and hence	**
$*^{100}$Y^m	T : a preferable feeding to the low-spin isomer	**
$*^{100}$Y^m	J : direct β^- feeding to 0+ states in ^{100}Zr in 86Wo01;	**
$*^{100}$Y^m	J : p5/2[422] n3/2[411], K=1+ configuration	**
$*^{100}$Y^m	D : %β^-n other (after 93Ru01) 96Me09=1.8(0.6) 02Pf04=1.16(0.32), compilation	**
$*^{100}$Nb^n	E : 34.3 keV above the 5+ isomer	**
$*^{100}$Nb^n	J : a cascade of two M1 gamma rays from 6- and absence of gamma from 8-	**
$*^{100}$Nb^p	E : 420.7 keV above the 5+ isomer	**
$*^{100}$Nb^p	J : 28 keV gamma, (E2) to (6-)	**
$*^{100}$Mo	T : 2ν-$\beta\beta$ symmetrized from 20Ba.A=7.06(+0.15-0.13) (evaluation); others	**
$*^{100}$Mo	T : (recent) 20Ar09=7.12(+0.18-0.14,stat)(0.10,syst)	**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{100}Mo T : 19Ar04=6.81(0.01,stat)(+0.38-0.40,syst) **
*^{100}Mo T : 17Ar18=6.90(0.15,stat)(0.37,syst) 15Ba11=7.1(0.4) (evaluation) **
*^{100}Ag J : 14Fe01=(5) **
*^{100}Sn T : also 12Hi07=1.16(0.20) 08Ba53=0.55(+0.70-0.31) 96Ki23=0.94(+0.54-0.26) **

^{101}Kr	−28580#	500#					9#	ms	>400ns	5/2$^+$#	10	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{101}Rb	−42567	20					31.8	ms	3.3	3/2$^+$#	06	11Ni01	T	1992	β^-=100;β^-n=28 4;β^-2n ?	*
^{101}Sr	−55325	8					113.7	ms	1.7	(5/2$^-$)	06	02Pf04	D	1983	β^-=100;β^-n=2.75 35	*
^{101}Y	−65055	7					426	ms	20	5/2$^+$*	06	02Pf04	D	1983	β^-=100;β^-n=2.3 8	*
^{101}Y^m	−63850	7	1205.0	1.0			870	ns	90	13/2$^-$#		09Fo05	ETD	2009	IT=100	*
^{101}Zr	−73161	8					2.29	s	0.08	3/2$^+$*	06			1972	β^-=100	*
^{101}Nb	−78891	4					7.1	s	0.3	5/2$^+$*	06			1970	β^-=100	*
^{101}Mo	−83520.0	0.3					14.61	m	0.03	1/2$^+$	06			1941	β^-=100	
^{101}Mo^m	−83506.5	0.3	13.497	0.009			226	ns	7	3/2$^+$	06			1977	IT=100	
^{101}Mo^n	−83463.0	0.3	57.015	0.011			133	ns	70	5/2$^+$	06			1977	IT=100	
^{101}Tc	−86345	24					14.22	m	0.01	9/2$^+$	06			1941	β^-=100	
^{101}Tc^m	−86137	24	207.526	0.020			636	μs	8	1/2$^-$	06			1964	IT=100	
^{101}Ru	−87958.1	0.4					STABLE			5/2$^+$*	06			1931	IS=17.06 2	
^{101}Ru^m	−87430.5	0.4	527.56	0.10			17.5	μs	0.4	11/2$^-$	06			1974	IT=100	
^{101}Rh	−87412	6					4.07	y	0.05	1/2$^-$	06	18Sh09	T	1948	ε=100	
^{101}Rh^m	−87255	6	157.32	0.03			4.343	d	0.010	9/2$^+$*	06			1944	ε=92.80 25;IT=7.20 25	*
^{101}Pd	−85432	5					8.47	h	0.06	5/2$^+$	06			1948	β^+=100	
^{101}Ag	−81334	5					11.1	m	0.3	9/2$^+$*	06			1966	β^+=100	*
^{101}Ag^m	−81060	5	274.1	0.3			3.10	s	0.10	(1/2)$^-$*	06			1975	IT=100	*
^{101}Cd	−75836.5	1.5					1.36	m	0.05	5/2$^+$*	06	18Yo07	J	1969	β^+=100	
^{101}In	−68545	12					15.1	s	1.1	(9/2$^+$)	06	19Pa16	D	1988	β^+=100;β^+p<1.7	*
^{101}In^m	−67910	40	640	40	MD		10#	s		1/2$^-$#		20Ho03	E	2019	β^+ ?;IT ?	*
^{101}Sn	−60310	300					2.22	s	0.05	(7/2$^+$)	07	19Pa16	TD	1994	β^+=100;β^+p=21.0 7	*

*^{101}Rb T : average 11Ni01=31(+5-4) 95Lh04=32(5) **
*^{101}Sr T : average 11Ni01=113(2) 86Wa17=114(4) 83Wo10=121(6) 87PfZX=104(15) **
*^{101}Y T : average 96Me09=400(20) 86Wa17=440(20) 83Wo10=500(50); others **
*^{101}Y T : 09Pe06=510(+76-67) 12Qu01=480(+143-114) 93Ru01=279(9), outlier **
*^{101}Y J : 07Ch07=5/2 **
*^{101}Y^m T : symmetrized from 09Fo05=860(+90-80); other 12Ka36=187(+49-38) **
*^{101}Y^m E : E(13/2+)=724.98(10) keV from 05Lu21 + 480(1) keV from 09Fo05 **
*^{101}Y^m I : 09Fo05=129,164,204,230 and 480 gamma rays in a cascade to gs, the first **
*^{101}Y^m I : four in agreement with SF data of 05Lu21; other 12Ka36=128.0(0.5) and **
*^{101}Y^m I : 203.5(0.5) gamma rays in a cascade to gs, but limited statistics **
*^{101}Zr T : average 19Do02=2.27(0.12) 72Th08=2.3(0.1) **
*^{101}Zr J : 02Ca37=3/2 **
*^{101}Nb J : 09Ch25=5/2 **
*^{101}Rh^m T : average 68Li08=4.39(0.08) 66Ar05=4.34(0.01) **
*^{101}Rh^m T : 65Er04=4.43(0.06); Birge ratio=3.22 **
*^{101}Ag J : other 14Fe01=9/2 **
*^{101}Ag^m J : 14Fe01=(1/2) **
*^{101}In T : average 97Sz04=14.9(1.2) 88Hu07=16(3) **
*^{101}In^m E : average 20Ho03=608(57) 19Xu13=659(50) **
*^{101}Sn D : %β^+p average 19Pa16=23.6(0.8) 12Lo08=22(1) 10St.A=20(1) **
*^{101}Sn J : from 10Da17 **

^{102}Rb	−37250	80					37	ms	4	(4$^+$)	09	16Wa16	JD	1995	β^-=100;β^-n=65 22;β^-2n ?	*
^{102}Sr	−52160	70					69	ms	6	0$^+$	09			1986	β^-=100;β^-n=5.5 15	*
^{102}Y	−61173	4				*	360	ms	40	(5$^-$)	09	17Br12	ID	1980	β^-=100;β^-n<2.6	*
^{102}Y^m	−61070#	100#	100#	100#		*	300	ms	100	(0$^-$,1$^-$)	09			1983	β^-=100;β^-n<2.6;IT ?	*
^{102}Zr	−71581	9					2.01	s	0.08	0$^+$	09	19Do02	T	1970	β^-=100	
^{102}Nb	−76298.3	2.5					4.3	s	0.4	(4$^+$)	09			1972	β^-=100	
^{102}Nb^m	−76204	8	94	7	MD		1.31	s	0.16	(1$^+$)	09	19Do02	T	1976	β^-=100; IT ?	*
^{102}Mo	−83561	8					11.3	m	0.2	0$^+$	09			1954	β^-=100	
^{102}Tc	−84573	9				*	5.28	s	0.15	1$^+$	09			1954	β^-=100	
^{102}Tc^m	−84520#	50#	50#	50#		*	4.35	m	0.07	(4$^+$)	09			1954	$\beta^-\approx$100;IT ?	*
^{102}Ru	−89106.4	0.4					STABLE			0$^+$	09			1931	IS=31.55 14	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{102}Rh	−86783	6			207.0	d	1.5	2−*	09	98Sh21	T	1941	β^+=78 5;β^-=22 5	*
^{102}Rh^m	−86642	6	140.73	0.09	3.742	y	0.010	6+*	09	99Gi14	J	1962	β^+≈100;IT=0.233 24	
^{102}Pd	−87903.0	0.4			STABLE		>7.6Ey	0+	09	16Le16	T	1935	IS=1.02 1;2β^+ ?	
^{102}Ag	−82247	8			12.9	m	0.3	5+*	09			1960	β^+=100	
^{102}Ag^m	−82238	8	9.40	0.07	7.7	m	0.5	2+*	09			1967	β^+=51 5;IT=49 5	
^{102}Cd	−79659.7	1.7			5.5	m	0.5	0+	09			1969	β^+=100	
^{102}In	−70695	5			23.3	s	0.1	(6+)	09	95Sz01	J	1981	β^+=100;β^+p=0.0093 13	
^{102}Sn	−64930	100			3.8	s	0.2	0+	09			1994	β^+=100	*
^{102}Sn^m	−62910	100	2017	2	367	ns	8	(6+)	09	98Li50	E	1996	IT=100	*
^{102}Sb	−51100#	400#											p ?	

*^{102}Rb T : average 15Lo04=37(10) 11Ni01=35(+15-8) 87PfZX=37(5) **
*^{102}Rb D : other %β^-n=18(8) in 87PfZX **
*^{102}Sr T : also 11Ni01=85(15) **
*^{102}Y J : direct β^- feeding of 4- and 5- levels in ^{102}Zr in 17Br12; **
*^{102}Y J : p5/2[422]n5/2[532], K=5- configuration from systematics **
*^{102}Y T : from 91Hi02 for the high-spin β^- decaying state **
*^{102}Y D : from %β^-n=4.9 12, average 86ReZS=6.0(1.7) 96Me09=4.0(1.5), **
*^{102}Y D : and by splitting equally between gs and isomer **
*^{102}Y^m J : direct β^- feeding of ^{102}Sr (0+) - see discussion in 91Hi02; **
*^{102}Y^m J : p5/2[422]n5/2[532], K=0- configuration from systematics; other **
*^{102}Y^m J : 07Ch07=(2,3) **
*^{102}Y^m T : from 91Hi02 for the low-spin β^- decaying state **
*^{102}Y^m D : from %β^-n=4.9 12, average 86ReZS=6.0(1.7) 96Me09=4.0(1.5), **
*^{102}Y^m D : and by splitting equally between gs and isomer **
*^{102}Nb^m T : average 19Do02=1.33(0.27) 76Ah06=1.3(0.2) **
*^{102}Tc^m J : direct β^- feeding of J=4 and 5 levels and the lack of such to the 6+ **
*^{102}Tc^m J : levels in ^{102}Ru in 70Hu02 and 69Bl16 **
*^{102}Rh T : average 98Sh21=207.3(1.7) 61Hi06=206(3) **
*^{102}Pd T : 16Le16 (supersedes 13Le10) >8.8Ey, >7.6Ey for the first excited **
*^{102}Pd T : 0+ and 2+ states, and >14Ey for the second excited 2+ **
*^{102}Sn T : 95Fa.A=4.6(1.4), supersedes 95Sc28=4.5(0.7) from the same group **
*^{102}Sn^m T : from 11Hi.A **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{103}Rb	−33160#	400#			26	ms	11	3/2+#	15	15Lo04	TD	2010	β^-=100;β^-n ?;β^-2n ?	*
^{103}Sr	−47280#	200#			53	ms	10	5/2+#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{103}Y	−58457	11			239	ms	12	5/2+#	09	11Ni01	T	1994	β^-=100;β^-n=8.0 17	*
^{103}Zr	−67809	9			1.38	s	0.07	(5/2−)	09	09Pe06	TD	1987	β^-=100;β^-n<1	
^{103}Nb	−75029	4			1.34	s	0.07	5/2+*	09	19Do02	T	1971	β^-=100;β^-n ?	*
^{103}Mo	−80954	9			67.5	s	1.5	3/2+	09	09Ch09	J	1963	β^-=100	
^{103}Tc	−84604	10			54.2	s	0.8	5/2+	09			1957	β^-=100	
^{103}Ru	−87267.2	0.4			39.245	d	0.008	3/2+	09	FGK204	T	1945	β^-=100	
^{103}Ru^m	−87029.0	0.8	238.2	0.7	1.69	ms	0.07	11/2−	09			1964	IT=100	
^{103}Rh	−88031.7	2.3			STABLE			1/2−*	09			1934	IS=100	
^{103}Rh^m	−87991.9	2.3	39.753	0.006	56.114	m	0.009	7/2+	09			1943	IT=100	
^{103}Pd	−87457.0	0.9			16.991	d	0.019	5/2+	09			1950	ε=100	
^{103}Ag	−84803	4			65.7	m	0.7	7/2+*	09			1954	β^+=100	
^{103}Ag^m	−84669	4	134.45	0.04	5.7	s	0.3	1/2−	09			1962	IT=100	
^{103}Cd	−80651.6	1.8			7.3	m	0.1	5/2+*	09	18Yo07	J	1960	β^+=100	
^{103}In	−74632	9			60	s	1	(9/2+)	09	97Sz04	T	1978	β^+=100	
^{103}In^m	−74000	9	631.7	0.1	34	s	2	(1/2−)	09			1988	β^+=67;IT=33	*
^{103}Sn	−67090#	100#			7.0	s	0.2	5/2+#	09			1981	β^+=100;β^+p=1.2 1	
^{103}Sb	−56670#	300#					<49ns	5/2+#	15	13Su23	I	2010	p ?	

*^{103}Rb T : symmetrized from 15Lo04=23(+13-9) **
*^{103}Y T : average 11Ni01=234(+18-15) 09Pe06=260(+40-20) 96Me09=230(20) **
*^{103}Y T : 96Lh04=190(50) **
*^{103}Y D : %β^-n average 09Pe06=8(2) 96Me09=8(3) **
*^{103}Nb J : 09Ch25=5/2 **
*^{103}In^m E : other 20Ho03=689(77) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{104}Rb	−27450#	500#			35#	ms	>550ns			18Sh11	IT	2018	β^- ?;β^-n ?;β^-2n ?	
^{104}Sr	−43760#	300#			50.6	ms	4.2	0+	15	15Lo04	T	1997	β^-=100;β^-n ?;β^-2n ?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{104}Y	−54080#	200#				197	ms	4	$(0^+,1^+)$#	15	09Pe06	D	1994	β^-=100;β^-n=34 10;β^-2n ?	*
^{104}Zr	−65718	9				920	ms	28	0^+	07	09Pe06	TD	1990	β^-=100;β^-n<1	
^{104}Nb	−71811.0	1.8			*	0.98	s	0.05	(5^-)	07			1976	β^-=100;β^-n=0.05 3	*
^{104}Nb^m	−71801.2	1.9	9.8	2.6	MD*	4.9	s	0.3	$(0^-,1^-)$	07	FGK207	J	1971	β^-=100;β^-n=0.06 3	*
^{104}Mo	−80344	9				60	s	2	0^+	07			1962	β^-=100	
^{104}Tc	−82499	25				18.3	m	0.3	(3^-)	07			1956	β^-=100	*
^{104}Tc^m	−82429	25	69.7	0.2		3.5	μs	0.3	(5^-)	07			1981	IT=100	*
^{104}Tc^n	−82393	25	106.1	0.3		400	ns	20	4#	07			1999	IT=100	
^{104}Ru	−88095.8	2.5				STABLE			0^+	07			1931	IS=18.62 27;2β^- ?	*
^{104}Rh	−86959.3	2.3				42.3	s	0.4	1^+	07			1939	β^-=99.55 10;β^+=0.45 10	
^{104}Rh^m	−86830.3	2.3	128.9679	0.0005		4.34	m	0.03	5^+	07			1939	IT=99.87 1;β^-=0.13 1	
^{104}Pd	−89395.1	1.3				STABLE			0^+	07			1935	IS=11.14 8	
^{104}Ag	−85116	4				69.2	m	1.0	5^+*	07			1955	β^+=100	
^{104}Ag^m	−85109	4	6.90	0.22		33.5	m	2.0	2^+*	07			1959	$\beta^+\approx$100;IT<0.07	
^{104}Cd	−83968.4	1.7				57.7	m	1.0	0^+	07			1955	β^+=100	
^{104}In	−76183	6				1.80	m	0.03	(5^+)*	07			1977	β^+=100	
^{104}In^m	−76090	6	93.48	0.10		15.7	s	0.5	(3^+)	07	89Va05	D	1988	IT=80 5;β^+=20 5	
^{104}Sn	−71627	6				20.8	s	0.5	0^+	07			1985	β^+=100	
^{104}Sb	−59300#	100#				470	ms	130		07	96FaZZ	TD	1995	β^+=?;β^+p<7;p<7;α ?	*
^{104}Te	−49630	320				< 4	ns		0^+		18Au04	D	2018	α=100	*

*^{104}Sr T : average 15Lo04=53(5) 11Ni01=43(+9-7) **
*^{104}Y T : average 15Lo04=198(20) 11Ni01=197(4) 99Wa09=180(60); other **
*^{104}Y T : 09Pe06=260(+60-50) 99Wa09=180(60) **
*^{104}Nb T : average 19Do02=0.97(0.10) 96Me09=1.0(0.1) 82Ke05=0.99(0.07) **
*^{104}Nb T : 76Ah06=0.8(0.2); other 80BaZL=0.91, no uncertainty quoted **
*^{104}Nb^m D : %β^-n other 83En03=0.71%, conflicting (not used) **
*^{104}Tc J : strong β^- feeding to 2+, 2- and 4+ levels in ^{104}Ru; **
*^{104}Tc J : expected conf=p3/2[301] n3/2[411], K=3- **
*^{104}Tc^m J : E2 gamma to (3-) level (from Ensdf2007) **
*^{104}Ru T : 0nu-BB to 1st exc. state : 13Be09>650Ey 12An08>190Ey **
*^{104}Sb T : symmetrized from 96FaZZ=440(+150-110), supersedes 95Sc28, **
*^{104}Sb T : 95Sc33=520(+180,-130) **
*^{104}Sb D : %p from 96FaZZ, supersedes 95Sc28<1% **
*^{104}Te T : from 19Xi06; other 18Au04<18 ns **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{105}Sr	−38190#	500#				39	ms	5	$5/2^+$#	19			1997	β^-=100;β^-n ?;β^-2n ?	
^{105}Y	−50570#	400#				95	ms	9	$5/2^+$#	19	09Pe06	D	1994	β^-=100;β^-n<82;β^-2n ?	*
^{105}Zr	−61458	12				670	ms	28	$1/2^+$#	19	09Pe06	TD	1992	β^-=100;β^-n<2	*
^{105}Nb	−69916	4				2.91	s	0.05	$(5/2^+)$	19			1984	β^-=100;β^-n=1.7 9	
^{105}Mo	−77331	9				36.3	s	0.8	$(5/2^-)$	19			1962	β^-=100	
^{105}Tc	−82290	40				7.64	m	0.06	$(3/2^-)$	19			1955	β^-=100	
^{105}Ru	−85934.5	2.5				4.439	h	0.011	$3/2^+$	19			1945	β^-=100	
^{105}Ru^m	−85913.9	2.5	20.606	0.014		340	ns	15	$5/2^+$	19			1974	IT=100	
^{105}Rh	−87851.3	2.5				35.341	h	0.019	$7/2^+$	19			1945	β^-=100	
^{105}Rh^m	−87721.6	2.5	129.742	0.004		42.8	s	0.3	$1/2^-$	19			1950	IT=100	
^{105}Pd	−88417.9	1.1				STABLE			$5/2^+$*	19			1935	IS=22.33 8	
^{105}Pd^m	−87928.8	1.1	489.1	0.3		35.5	μs	0.5	$11/2^-$	19			1970	IT=100	
^{105}Ag	−87071	5				41.29	d	0.07	$1/2^-$*	19			1939	β^+=100	
^{105}Ag^m	−87046	5	25.468	0.016		7.23	m	0.16	$7/2^+$	19			1969	IT=99.66 7;β^+=0.34 7	
^{105}Cd	−84333.8	1.4				55.5	m	0.4	$5/2^+$*	19			1950	β^+=100	*
^{105}Cd^m	−81816.2	1.5	2517.6	0.5		4.5	μs	0.5	$(21/2^+)$	19			1976	IT=100	
^{105}In	−79641	10				5.07	m	0.07	$9/2^+$*	19			1975	β^+=100	
^{105}In^m	−78967	10	674.09	0.25		48	s	6	$(1/2)^-$	19			1975	IT$\approx$100;β^+ ?	*
^{105}Sn	−73338	4				32.7	s	0.5	$(5/2^+)$	19			1981	β^+=100;β^+p=0.011 4	
^{105}Sb	−64015	22				1.12	s	0.16	$(5/2^+)$	05	96FaZZ	T	1994	β^+=100;p<0.1;β^+p ?	*
^{105}Te	−52810	300				633	ns	66	$(7/2^+)$	06	06Se08	T	2006	$\alpha\approx$100	*

*^{105}Y T : symmetrized from 15Lo04=107(+6-9); others 11Ni01=83(+5-4) **
*^{105}Y T : 09Pe06=160(+85-60) **
*^{105}Zr J : 20Ur02=1/2+, 1/2+[411] **
*^{105}Cd J : also 18Yo07=5/2 **
*^{105}In^m E : other 20Ho03=702(27) **
*^{105}Sb T : from 96FaZZ, supersedes 95Sc28=1.30(0.15) (preliminary, the same group) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{105}Sb	D : %p from 05Li47<0.1% above 430 keV, disagrees with 96FaZZ,94Ti03 1%														**
*^{105}Te	T : average 06Li41=620(70) 06Se08=700(+250-170)														**
*^{105}Te	J : favorite α decay to the 171.7-keV state [J=(7/2+)] in ^{101}Sn														**
^{106}Sr	−34300#	600#				21	ms	8	0^+	15	15Lo04	T	2010	β^-=100;β^-n ?;β^-2n ?	*
^{106}Y	−45790#	500#				75	ms	6	2^+#	15	15Lo04	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{106}Zr	−58750#	200#				179	ms	6	0^+	15	15Lo04	T	1994	β^-=100;β^-n<7	*
^{106}Nb	−66202.7	1.4				900	ms	20	1^-#	15	14Lu07	J	1976	β^-=100;β^-n=4.5 3	*
^{106}Nb^m	−66100#	50#	100#	50#		1.20	s	0.06	(4^-)		20Ha14	TJ	1976	β^-=100; IT ?	*
^{106}Nb^n	−65997.9	1.5	204.8	0.5		820	ns	38	(3^+)		14Lu07	EJ	1999	IT=100	*
^{106}Mo	−76128	9				8.73	s	0.12	0^+	08			1969	β^-=100	
^{106}Tc	−79776	12				35.6	s	0.6	$(1,2)(^+\#)$	08			1965	β^-=100	
^{106}Ru	−86323	5				371.8	d	0.18	0^+	08			1948	β^-=100	
^{106}Rh	−86363	5				30.07	s	0.35	1^+	08			1947	β^-=100	
^{106}Rh^m	−86231	10	132	11	BD	131	m	2	$(6)^+$	08			1955	β^-=100	
^{106}Pd	−89907.5	1.1				STABLE			0^+	08			1935	IS=27.33 3	
^{106}Ag	−86942	3				23.96	m	0.04	1^+*	08			1937	$\beta^+\approx$100;β^- ?	
^{106}Ag^m	−86852	3	89.66	0.07		8.28	d	0.02	6^+*	08			1938	β^+=100;IT ?	
^{106}Cd	−87132.2	1.1				STABLE		>1.1Zy	0^+	08	16Be11	T	1935	IS=1.245 22;2β^+ ?	*
^{106}In	−80608	12				6.2	m	0.1	7^+*	08			1962	β^+=100	
^{106}In^m	−80579	12	28.6	0.3		5.2	m	0.1	$(2)^+$	08			1966	β^+=100	
^{106}Sn	−77354	5				1.92	m	0.08	0^+	08			1975	β^+=100	
^{106}Sb	−66473	7				600	ms	200	(2^+)	08			1981	β^+=100	
^{106}Sb^m	−66370	7	103.5	0.3		226	ns	14	(4^+)	08	99So08	T	1998	IT=100	*
^{106}Te	−58220	100				78	μs	11	0^+	08	16Ca33	T	1981	α=100	*
^{106}I	−43300#	400#												α ?	
*^{106}Sr	T : symmetrized from 15Lo04=20(+8-7)														**
*^{106}Y	T : average 15Lo04=82(+10-5) 15NiZZ=62(9); other 11Ni01=62(+25-14)														**
*^{106}Zr	T : average 15Lo04=175(7) 11Ni01=186(+11-10)														**
*^{106}Nb	T : from 96Me09 using β^-(t), predominantly from the low-spin β^-														**
*^{106}Nb	T : decaying state														**
*^{106}Nb^m	T : average 20Ha14=1.10(0.05) 09Pe06=1.24(0.02) 83Sh06=1.02(0.05);														**
*^{106}Nb^m	T : Birge ratio=3.2; contain contributions from the shorter gs														**
*^{106}Nb^n	T : average 12Ka36=660(+110-100) 99Ge01=840(40)														**
*^{106}Cd	T : for 2nu-$\varepsilon\beta^+$, theoretically fastest channel; others 12Be14>210Ey														**
*^{106}Cd	T : 02Tr04>410Ey														**
*^{106}Sb^m	T : average 99So08=232(21) 98Li50=220(20)														**
*^{106}Te	T : average 16Ca33=70(+20-15) 05Ja03=85(+25-15) 94Pa11=60(+40-20) and														**
*^{106}Te	T : 81Sc17=60(+30-10)														**
^{107}Sr	−28250#	700#				25#	ms	>400ns	$1/2^+$#	10	10Oh02	I	2010	β^- ?;β^-n ?;β^-2n ?	
^{107}Y	−41970#	500#				33.5	ms	0.3	$5/2^+$#	15	15Lo04	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{107}Zr	−54020#	300#				145.7	ms	2.4	$5/2^+$#	15	15Lo04	T	1994	β^-=100;β^-n<23	*
^{107}Nb	−63724	8				286	ms	8	$(5/2^+)$	08	19Ku16	TJ	1992	β^-=100;β^-n=7.4 8	*
^{107}Mo	−72545	9				3.5	s	0.5	$(1/2^+)$	08	19Ku16	J	1972	β^-=100	*
^{107}Mo^m	−72480	9	65.4	0.2		445	ns	21	$(5/2^+)$	08	19Ku16	J	1976	IT=100	*
^{107}Tc	−78750	9				21.2	s	0.2	$(3/2^-)$	08	09Gu11	J	1965	β^-=100	
^{107}Tc^m	−78720	9	30.1	0.1		3.85	μs	0.05	$(1/2^+)$	08			2007	IT=100	
^{107}Tc^n	−78684	9	65.72	0.14		184	ns	3	$(5/2^+)$	08			1974	IT=100	
^{107}Ru	−83863	9				3.75	m	0.05	$(5/2)^+$	08			1951	β^-=100	
^{107}Rh	−86864	12				21.7	m	0.4	$7/2^+$	08			1951	β^-=100	
^{107}Rh^m	−86596	12	268.36	0.04		> 10	μs		$1/2^-$	08			1986	IT=100	
^{107}Pd	−88372.7	1.2				6.5	My	0.3	$5/2^+$	08			1958	β^-=100	
^{107}Pd^m	−88257.0	1.2	115.74	0.12		850	ns	100	$1/2^+$	08			1969	IT=100	
^{107}Pd^n	−88158.1	1.2	214.6	0.3		21.3	s	0.5	$11/2^-$	08			1952	IT=100	
^{107}Ag	−88406.7	2.4				STABLE			$1/2^-$*	08			1924	IS=51.839 8	*
^{107}Ag^m	−88313.6	2.4	93.125	0.019		44.3	s	0.2	$7/2^+$	08			1940	IT=100	
^{107}Cd	−86990.3	1.7				6.50	h	0.02	$5/2^+$*	08			1946	β^+=100	*
^{107}In	−83567	10				32.4	m	0.3	$9/2^+$*	08			1949	β^+=100	
^{107}In^m	−82889	10	678.5	0.3		50.4	s	0.6	$1/2^-$	08			1973	IT=100	*
^{107}Sn	−78512	5				2.90	m	0.05	$(5/2^+)$	08			1976	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{107}Sb	−70653	4				4.0	s	0.2	5/2$^+$#	08			1994	β^+=100	
^{107}Te	−60660#	100#				3.22	ms	0.09	5/2$^+$#	08	19Au02	T	1979	α=70 30;β^+ ?;β^+p ?	*
^{107}I	−49430#	300#				20#	μs		5/2$^+$#					α ?	
*^{107}Y	T : other 11Ni01=41(+15-9)														**
*^{107}Zr	T : average 15Lo04=150(3) 11Ni01=138(4); not used 09Pe06=150(+40-30)														**
*^{107}Nb	T : average 19Ku16=270(20) 15Lo04=280(20) 09Pe06=290(11) 96Me09=300(30)														**
*^{107}Nb	D : %β^-n average 09Pe06=8(1) 96Me09=6.0(1.5)														**
*^{107}Mo	J : 20Ur02,19Ku16=1/2+, 1/2+[411]														**
*^{107}Mo^m	T : average 06Pi14=420(30) 99Ge01=470(30); others 20Ur02=600(150)														**
*^{107}Mo^m	T : 76ChZD=238(7)														**
*^{107}Mo^m	J : 20Ur02,19Ku16=5/2+, 5/2+[413]														**
*^{107}Ag	J : also 14Fe01=1/2														**
*^{107}Cd	J : also 18Yo07,13Yo02=5/2														**
*^{107}In^m	E : other 20Ho03=663(22)														**
*^{107}Te	T : average 19Au02=3.6(0.2) 14Pa11=3.1(0.1) 79Sc22=3.6(+0.6-0.4)														**
^{108}Y	−36780#	600#				30	ms	5	6$^-$#	15	15Lo04	T	2010	β^-=100;β^-n ?;β^-2n ?	*
^{108}Zr	−50950#	400#				78.5	ms	2.0	0$^+$	15			1997	β^-=100;β^-n ?	
^{108}Zr^m	−48880#	400#	2074.5	0.8		540	ns	30	(6$^+$)	15	12Ka36	T	2011	IT=100	*
^{108}Nb	−59545	8				201	ms	4	(2$^+$)	15	20Ha14	T	1994	β^-=100;β^-n=6.3 5;β^-2n ?	*
^{108}Nb^m	−59378	8	166.6	0.5		109	ns	2	6$^-$#	15	12Ka36	DT	2012	IT=100	
^{108}Mo	−70749	9				1.105	s	0.010	0$^+$	08	09Pe06	TD	1972	β^-=100;β^-n<0.5	*
^{108}Tc	−75923	9				5.17	s	0.07	(2)$^+$	08			1970	β^-=100	
^{108}Ru	−83661	9				4.55	m	0.05	0$^+$	08			1955	β^-=100	
^{108}Rh	−85031	14				16.8	s	0.5	1$^+$	08			1955	β^-=100	
^{108}Rh^m	−84917	12	115	18	MD	6.0	m	0.3	(5$^+$)	08			1969	β^-=100	
^{108}Pd	−89524.2	1.1				STABLE			0$^+$	08			1935	IS=26.46 9	
^{108}Ag	−87606.8	2.4				2.382	m	0.011	1$^+$*	08			1937	β^-=97.15 20;β^+=2.85 20	
^{108}Ag^m	−87497.3	2.4	109.466	0.007		439	y	9	6$^+$*	08	18Sh09	T	1969	β^+=91.3 9;IT=8.7 9	*
^{108}Cd	−89252.4	1.1				STABLE		>410Py	0$^+$	08	95Ge14	T	1935	IS=0.888 11;2β^+ ?	
^{108}In	−84120	9				58.0	m	1.2	7$^+$*	08			1949	β^+=100	
^{108}In^m	−84090	9	29.75	0.05		39.6	m	0.7	2$^+$*	08			1955	β^+=100	
^{108}Sn	−82070	5				10.30	m	0.08	0$^+$	08			1968	β^+=100	
^{108}Sb	−72445	5				7.4	s	0.3	(4$^+$)	08			1976	β^+=100	
^{108}Te	−65782	5				2.1	s	0.1	0$^+$	08	85Ti02	D	1974	β^+=51 4;α=49 4; β^+p=2.4 10;$\beta^+\alpha$<0.065	
^{108}I	−52770#	100#				26.4	ms	0.8	1$^+$#	08	19Au02	TD	1991	$\alpha\approx$99.50 21;p=0.50 21; β^+ ?;β^+p ?	
^{108}Xe	−42630	380				72	μs	35	0$^+$		18Au04	TD	2018	α=100	*
*^{108}Y	T : other 11Ni01=25(+66-10)														**
*^{108}Zr^m	T : symmetrized from 12Ka36=536(+26-25); other 11Su11=620(150)														**
*^{108}Nb	T : average 20Ha14=186(8) 15Lo04=195(6) 09Pe06=210(5)														**
*^{108}Nb	D : %β^-n other 20Ha14=18(11)														**
*^{108}Mo	T : average 09Pe06=1.110(0.011) 95Jo02=1.090(0.020)														**
*^{108}Ag^m	T : average 18Sh09=448(27) 04Sh04=438(9)														**
*^{108}Xe	T : average 19Xi06=30(+57-12) 18Au04=58(+106-23)														**
^{109}Y	−32480#	700#				25	ms	5	5/2$^+$#	16	15Lo04	T	2010	β^-=100;β^-n ?;β^-2n ?	
^{109}Zr	−45730#	500#				56	ms	3	5/2$^+$#	16			1997	β^-=100;β^-n ?;β^-2n ?	
^{109}Nb	−56690	430				106.9	ms	4.9	3/2$^-$#	16	15Lo04	T	1994	β^-=100;β^-n=31 5	*
^{109}Nb^m	−56380	430	312.5	0.4		115	ns	8	7/2$^+$#	16	12Ka36	T	2011	IT=100	*
^{109}Mo	−66659	11				700	ms	14	(1/2$^+$)	16	09Pe06	TD	1992	β^-=100;β^-n=1.3 6	*
^{109}Mo^m	−66589	11	69.7	0.5		210	ns	60	5/2$^+$#	16	12Ka36	ET	2012	IT=100	*
^{109}Tc	−74283	10				905	ms	21	(5/2$^+$)	16	19Do02	T	1976	β^-=100;β^-n=0.08 2	*
^{109}Ru	−80738	9				34.4	s	0.2	(5/2$^+$)	16			1967	β^-=100	
^{109}Ru^m	−80642	9	96.14	0.15		680	ns	30	(5/2$^-$)	16			1976	IT=100	
^{109}Rh	−84999	4				80.8	s	0.7	7/2$^+$	16			1972	β^-=100	
^{109}Rh^m	−84773	4	225.873	0.019		1.66	μs	0.04	3/2$^+$	16			1987	IT=100	
^{109}Pd	−87606.5	1.1				13.59	h	0.12	5/2$^+$	16			1937	β^-=100	
^{109}Pd^m	−87493.1	1.1	113.4000	0.0014		380	ns	50	1/2$^+$	16			1978	IT=100	
^{109}Pd^n	−87417.5	1.1	188.9903	0.0010		4.703	m	0.009	11/2$^-$	16			1957	IT=100	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{109}Ag	−88719.4	1.3				STABLE	$1/2^-$*	16			1924	IS=48.161 8	*
^{109}Ag^m	−88631.4	1.3	88.0337	0.0010		39.79 s 0.21	$7/2^+$*	16			1967	IT=100	
^{109}Cd	−88504.3	1.5				461.3 d 0.5	$5/2^+$*	16	FGK209	T	1950	ε=100	*
^{109}Cd^m	−88444.7	1.5	59.60	0.07		11.8 μs 1.6	$1/2^+$	16			1956	IT=100	
^{109}Cd^n	−88041.2	1.5	463.10	0.11		10.6 μs 0.4	$11/2^-$	16			1964	IT=100	
^{109}In	−86490	4				4.159 h 0.010	$9/2^+$*	16			1948	β^+=100	*
^{109}In^m	−85840	4	649.79	0.10		1.34 m 0.06	$1/2^-$	16			1966	IT=100	*
^{109}In^n	−84388	4	2101.86	0.11		210.0 ms 0.9	$19/2^+$	16			1963	IT=100[gs=100,m=0]	*
^{109}Sn	−82630	8				18.1 m 0.2	$5/2^+$*	16			1966	β^+=100	*
^{109}Sb	−76251	5				17.2 s 0.5	$5/2^+$#	16			1976	β^+=100	
^{109}Te	−67715	4				4.4 s 0.2	$(5/2^+)$	16			1967	β^+=96.1 13;α=3.9 13; β^+p=9.4 31;$\beta^+\alpha$<0.0049	*
^{109}I	−57673	7				92.8 μs 0.8	$(1/2^+,3/2^+)$	16			1984	p=99.986 4;α=0.014 4	*
^{109}Xe	−46170	300				13 ms 2	$(7/2^+)$	16			2006	$\alpha\approx$100;β^+ ?;β^+p ?	

*^{109}Nb	T : average 15Lo04=110(6) 11Ni01=100(+9-8); other 09Pe06=130(20)	**
*^{109}Nb	D : %β^-n other 09Pe06<15 conflicting	**
*^{109}Nb^m	T : symmetrized from 12Ka36=114(+8-7); other 11Wa03=150(30)	**
*^{109}Nb^m	J : from 11Wa03, based on conf=p7/2[413],K=7/2+ and oblate shape	**
*^{109}Mo	T : others 15Lo04=700(+40-60), 92Ay02=530(60)	**
*^{109}Mo	J : 20Ur02=1/2+, 1/2+[411]	**
*^{109}Mo^m	T : symmetrized from 12Ka36=194(+76-49)	**
*^{109}Mo^m	J : 20Ur02=5/2+, 5/2+[413]	**
*^{109}Tc	T : average 19Do02=870(70) 09Pe06=1040(110) 96Me09=820(100) 92PeZX=870(40)	**
*^{109}Tc	T : 69WiZX=930(30) 90Al43=900(100)	**
*^{109}Ag	J : 50Cr26,37Ja01=1/2	**
*^{109}Cd	J : also 18Yo07,13Yo02=5/2	**
*^{109}In	J : 58Ma43,59Ma19=9/2	**
*^{109}In^m	E : other 20Ho03=651(27)	**
*^{109}In^n	E : other 20Ho03=2098(11)	**
*^{109}Sn	J : 87Eb01=5/2, but in conflict with 74Ho17=7/2	**
*^{109}I	T : other (not used) 19Xi06=89.3(6.0)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{110}Zr	−42220#	500#				37.5 ms 2.0	0^+	12	15Lo04	T	1997	β^-=100;β^-n ?;β^-2n ?	
^{110}Nb	−52310	840			*	75 ms 1	5^+#	12	20Ha14	TD	1994	β^-=100;β^-n=40 8;β^-2n ?	
^{110}Nb^m	−52210#	840#	100#	50#	*	94 ms 9	2^+#	12	20Ha14	TD	2020	β^-=100;IT ?;β^-n=40 8; β^-2n ?	*
^{110}Mo	−64536	24				292 ms 7	0^+	12	15Lo04	T	1992	β^-=100;β^-n=2.0 7	
^{110}Tc	−71035	9				900 ms 13	$(2^+,3^+)$	12			1976	β^-=100;β^-n=0.04 2	
^{110}Ru	−80073	9				12.04 s 0.17	0^+	12			1970	β^-=100	
^{110}Rh	−82829	18			*	3.35 s 0.12	(1^+)	12			1963	β^-=100	
^{110}Rh^m	−82610#	150#	220#	150#	*	28.5 s 1.3	(6^+)	12			1969	β^-=100	
^{110}Pd	−88330.9	0.6				STABLE >290Ey	0^+	12	16Le16	T	1935	IS=11.72 9;2β^- ?	*
^{110}Ag	−87457.3	1.3				24.56 s 0.11	1^+*	12			1937	$\beta^-\approx$100;ε=0.30 6	
^{110}Ag^m	−87456.2	1.3	1.112	0.016		660 ns 40	2^-	12			1975	IT=100	
^{110}Ag^n	−87339.7	1.3	117.59	0.05		249.863 d 0.024	6^+*	12	FGK209	T	1938	β^-=98.67 8;IT=1.33 8	
^{110}Cd	−90348.0	0.4				STABLE	0^+	12			1925	IS=12.470 61	
^{110}In	−86470	12				4.92 h 0.08	7^+*	12			1939	β^+=100	
^{110}In^m	−86408	12	62.08	0.04		69.1 m 0.5	2^+*	12			1962	β^+=100	
^{110}Sn	−85842	14				4.154 h 0.004	0^+	12			1965	ε=100	
^{110}Sb	−77450	6				23.6 s 0.3	(3^+)	12			1972	β^+=100	
^{110}Te	−72230	7				18.6 s 0.8	0^+	12			1977	$\beta^+\approx$100;α ?	
^{110}I	−60470	60				664 ms 24	(1^+)	12			1977	β^+=83 4;α=17 4;β^+p=11 3; $\beta^+\alpha$=1.1 3	
^{110}Xe	−51920	100				93 ms 3	0^+	12			1981	α=64 35;β^+=36 35;β^+p ?	

*^{110}Nb	T : 20Ha14 $\beta-\gamma$(t) gated on gamma's depopulating 5+ and 6+ levels;	**
*^{110}Nb	T : others 15Lo04=82(2) 11Ni01=86(6) 11Wa26=81(6), 75(9)	**
*^{110}Nb	T : 96Me09=170(20) both for the gs and isomer	**
*^{110}Nb	D : %β^-n from 96Me09 includes both gs and isomer	**
*^{110}Nb^m	T : 20Ha14 beta-gamma time gated on gamma depopulating 2+ following	**
*^{110}Nb^m	T : 110Zr->110Nb->110Mo decay; only low spin levels are populated	**
*^{110}Nb^m	D : %β^-n from 96Me09 includes both gs and isomer	**
*^{110}Pd	T : 16Le16 supersedes 13Le10	**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{111}Zr	−36480#	600#				24.0	ms	0.5	$5/2^+$#	15	15Lo04	T	2010	β^-=100;β^-n ?;β^-2n ?	
^{111}Nb	−48960#	300#				54	ms	2	$3/2^-$#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{111}Mo	−59940	13				193.6	ms	4.4	$1/2^+$#	15	15Lo04	T	1994	β^-=100;β^-n<12	*
^{111}Mo^m	−59840#	50#	100#	50#		∼200	ms		$7/2^-$#	15			2011	β^-=100;β^-n ?	
^{111}Tc	−69025	11				350	ms	11	$5/2^+$#	09	09Pe06	T	1988	β^-=100;β^-n=0.85 20	*
^{111}Ru	−76785	10				2.12	s	0.07	$5/2^+$	09			1971	β^-=100	
^{111}Rh	−82304	7				11	s	1	$(7/2^+)$	09			1975	β^-=100	
^{111}Pd	−85985.9	0.7				23.56	m	0.09	$5/2^+$	09	15Kr07	T	1937	β^-=100	*
^{111}Pd^m	−85813.7	0.7	172.18	0.08		5.563	h	0.013	$11/2^-$	09	15Kr07	TD	1952	IT=76.8 10;β^-=23.2 10	
^{111}Ag	−88215.4	1.5				7.433	d	0.010	$1/2^-$*	09	16Co01	T	1937	β^-=100	*
^{111}Ag^m	−88155.6	1.5	59.82	0.04		64.8	s	0.8	$7/2^+$	09			1957	IT=99.3 2;β^-=0.7 2	
^{111}Cd	−89252.2	0.4				STABLE			$1/2^+$*	09			1925	IS=12.795 12	*
^{111}Cd^m	−88856.0	0.4	396.214	0.021		48.50	m	0.09	$11/2^-$*	09			1945	IT=100	*
^{111}In	−88392	3				2.8048	d	0.0001	$9/2^+$*	09	FGK209	T	1947	ε=100	
^{111}In^m	−87855	3	536.99	0.07		7.7	m	0.2	$1/2^-$	09			1966	IT=100	
^{111}Sn	−85939	5				35.3	m	0.6	$7/2^+$*	09			1949	β^+=100	
^{111}Sn^m	−85684	5	254.71	0.04		12.5	μs	1.0	$1/2^+$	09			1972	IT=100	
^{111}Sb	−80837	9				75	s	1	$(5/2^+)$	09			1972	β^+=100	
^{111}Te	−73587	6				26.2	s	0.6	$(5/2)^+$	09	05Sh24	T	1967	β^+=100;β^+p=?	*
^{111}I	−64954	5				2.5	s	0.2	$5/2^+$#	09			1977	$\beta^+\approx$100;$\alpha\approx$0.088 9;β^+p ?	*
^{111}Xe	−54520#	120#				740	ms	200	$5/2^+$#	09	12Ca03	D	1979	β^+=89.6 1.9;α=10.4 1.9; β^+p ?	
^{111}Cs	−42900#	200#				1#	μs		$3/2^+$#					p ?	

*^{111}Mo T : average 15Lo04=196(5) 11Ku16=186(9); other 09Pe06=200(+41-36) **
*^{111}Tc T : other 96Me09=290(20), supersedes 88Pe13=300(30) **
*^{111}Pd T : average 15Kr07=23.6(0.1) 77Kr14=23.4(0.2) **
*^{111}Ag T : average 16Co01=7.423(0.013) 74Ro18=7.450(0.017) **
*^{111}Cd J : also 13Yo02=1/2 **
*^{111}Cd^m J : also 13Yo02=11/2 **
*^{111}Te T : others (not used) 67Ka01=19.0(7) 67Bo41=19.5(5), outliers **
*^{111}I D : %α from 78Ro19 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{112}Zr	−32420#	700#				43	ms	21	0^+	15	15Lo04	T	2010	β^-=100;β^-n ?;β^-2n ?	*
^{112}Nb	−44070#	300#				38	ms	2	1^+#	15	15Lo04	T	1997	β^-=100;β^-n ?;β^-2n ?	*
^{112}Mo	−57480#	200#				125	ms	5	0^+	15	15Lo04	T	1994	β^-=100;β^-n ?	
^{112}Tc	−65259	6				323	ms	6	(2^+)	15	15Lo04	T	1990	β^-=100;β^-n=1.5 2	*
^{112}Tc^m	−64907	6	352.3	0.7		150	ns	17		15	10Br15	T	2010	IT=100	*
^{112}Ru	−75631	10				1.75	s	0.07	0^+	15			1970	β^-=100	
^{112}Rh	−79730	40				3.4	s	0.4	(1^+)	15	99Lh01	T	1972	β^-=100	*
^{112}Rh^m	−79390	60	340	70	BD	6.73	s	0.15	(6^+)	15	99Lh01	T	1987	β^-=100	*
^{112}Pd	−86321	7				21.04	h	0.17	0^+	15			1951	β^-=100	
^{112}Ag	−86583.7	2.4				3.130	h	0.008	2^-*	15			1938	β^-=100	
^{112}Cd	−90574.86	0.25				STABLE			0^+	15			1925	IS=24.109 7	
^{112}In	−87990	4				14.88	m	0.15	1^+*	15			1947	β^+=62 4;β^-=38 4	
^{112}In^m	−87833	4	156.592	0.025		20.67	m	0.08	4^+*	15			1953	IT=100	
^{112}In^n	−87639	4	350.80	0.05		690	ns	50	$(7)^+$	15			1976	IT=100	
^{112}In^p	−87376	4	613.82	0.06		2.81	μs	0.03	8^-*	15			1976	IT=100	
^{112}Sn	−88655.05	0.29				STABLE			0^+	15			1927	IS=0.97 1;2β^+ ?	
^{112}Sb	−81599	18				53.5	s	0.6	(3^+)	15			1959	β^+=100	
^{112}Sb^m	−80773	18	825.9	0.4		536	ns	22	(8^-)	15			1976	IT=100	
^{112}Te	−77568	8				2.0	m	0.2	0^+	15			1976	β^+=100	
^{112}I	−67063	10				3.34	s	0.08	1^+#	15	78Ro19	D	1977	$\beta^+\approx$100;$\alpha\approx$0.0012; β^+p=0.88 10;$\beta^+\alpha$=0.104 12	*
^{112}Xe	−60026	8				2.7	s	0.8	0^+	15			1978	β^+=98.8 8;α=1.2 8;β^+p ?	*
^{112}Cs	−46420#	120#				490	μs	30	1^+#	15			1994	p$\approx$100;α<0.26	

*^{112}Zr T : symmetrized from 15Lo04=30(+30-10) **
*^{112}Nb T : other 11Ni01=33(+9-6) same group **
*^{112}Tc D : %β^-n from 99Wa09=1.5(0.2), supersedes 96Me09=2.6(0.5); other 09Pe06=4(1) **
*^{112}Tc T : others 09Pe06=290(11); 99Wa09=290(20), supersedes 96Me09=230(20) **
*^{112}Tc^m E : 12Ka36=93.1(0.5) keV and 259.2(0.5) keV gamma rays in cascade to gs **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{112}Tc^m T : from 10Br15=150(17); other 12Ka36=218(+60-43) **
*^{112}Rh T : 99Lh01=3.45(0.37) supersedes 91Jo11=2.1(0.3), 88Ay02=3.8(0.6) same group **
*^{112}Rh^m T : supersedes 88Ay02=6.8(0.2) of the same group **
*^{112}Xe D : %α symmetrized from 94Pa11=0.8(+1.1-0.5); other 78Ro19∼0.84 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{113}Zr	−26340#	300#				15#	ms	>550 ns	$3/2^+$		18Sh11	IT	2018	β^- ?;β^-n ?;β^-2n ?	
^{113}Nb	−40210#	400#				32	ms	4	$3/2^-$#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{113}Mo	−52650#	300#				80	ms	2	$5/2^+$#	15			1994	β^-=100;β^-n ?	
^{113}Tc	−62812	3				152	ms	8	$5/2^+$#	15			1992	β^-=100;β^-n=2.1 3	
^{113}Tc^m	−62698	3	114.4	0.5		527	ns	16	$5/2^-$#	15	12Ka36	T	2010	IT=100	*
^{113}Ru	−71870	40				800	ms	50	$(1/2^+)$	10			1988	β^-=100	
^{113}Ru^m	−71740	50	131	33		510	ms	30	$(7/2^-)$	10	98Ku17	E	1998	β^-= ?;IT= ?	*
^{113}Rh	−78767	7				2.80	s	0.12	$(7/2^+)$	10	93Pe11	J	1971	β^-=100	
^{113}Pd	−83590	7				93	s	5	$(5/2^+)$	10			1954	β^-=100	
^{113}Pd^m	−83509	7	81.1	0.3		300	ms	100	$(9/2^-)$	10			1993	IT=100	
^{113}Ag	−87027	17				5.37	h	0.05	$1/2^-$*	10			1949	β^-=100	
^{113}Ag^m	−86984	17	43.50	0.10		68.7	s	1.6	$7/2^+$	10			1958	IT=64 7;β^-=36 7	
^{113}Cd	−89043.29	0.24				8.04	Py	0.05	$1/2^+$*	10			1925	IS=12.227 7;β^-=100	*
^{113}Cd^m	−88779.75	0.24	263.54	0.03		13.89	y	0.11	$11/2^-$*	10	11Ko01	TD	1965	β^-=99.9036 19; IT=0.0964 19	*
^{113}In	−89367.12	0.19				STABLE			$9/2^+$*	10			1934	IS=4.281 52	
^{113}In^m	−88975.42	0.19	391.699	0.003		1.6579	h	0.0004	$1/2^-$*	10			1939	IT=100	*
^{113}Sn	−88328.1	1.6				115.08	d	0.04	$1/2^+$*	10	FGK209	T	1939	β^+=100	
^{113}Sn^m	−88250.7	1.6	77.389	0.019		21.4	m	0.4	$7/2^+$*	10			1961	IT=91.1 23;β^+=8.9 23	
^{113}Sb	−84417	17				6.67	m	0.07	$5/2^+$	10			1958	β^+=100	
^{113}Te	−78347	28				1.7	m	0.2	$(7/2^+)$	10			1974	β^+=100	
^{113}I	−71120	8				6.6	s	0.2	$5/2^+$#	10			1977	β^+=100;α=3.310e-5#;$\beta^+\alpha$?	
^{113}Xe	−62204	7				2.74	s	0.08	$5/2^+$#	10	85Ti02	D	1973	$\beta^+\approx$100;α=?;β^+p=7 4; $\beta^+\alpha\approx$0.007 4	*
^{113}Xe^m	−61800	7	403.6	1.4		6.9	μs	0.3	$(11/2^-)$		13Pr01	ETJ	2013	IT=100	
^{113}Cs	−51765	9				16.94	μs	0.09	$(3/2^+)$	15	16Ho16	T	1984	p=100	*
^{113}Ba	−39710#	300#				30#	ms		$5/2^+$#					p ?;α ?	

*^{113}Tc^m T : symmetrized from 12Ka36=526(+16-15); other 10Br15=500(100) **
*^{113}Ru^m E : above the 98-keV level and below 164-keV level **
*^{113}Cd T : from 07Be61=8.037(0.005,stat)(0.05,syst); **
*^{113}Cd T : other (recent) 09Da03=8.00(0.11)(syt 0.24) outweighed **
*^{113}Cd J : also 13Yo02=1/2 **
*^{113}Cd^m T : average 11Ko01=13.97(0.13) 72Wa11=14.6(0.5) 65Fl02=13.6(0.2) **
*^{113}Cd^m J : also 13Yo02=11/2 **
*^{113}In^m T : from Ensdf2010=99.476(0.023) m **
*^{113}Xe D : %α=0.0024-0.0204 from estimated limit for the reduced width in 85Ti02; **
*^{113}Xe D : %β^+p and %$\beta^+\alpha$ derived from β^+p/α=605(35) and **
*^{113}Xe D : β^+p/$\beta^+\alpha$=500-1500 in 85Ti02 **
*^{113}Cs T : average 16Ho16=16.9(0.1) (>10000 events) 15Wa02=17.1(0.2) (18000 events) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{114}Nb	−34960#	500#				17	ms	5	2^-#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{114}Mo	−49680#	300#				58	ms	2	0^+	15			1997	β^-=100;β^-n ?	
^{114}Tc	−58600	430			*	121	ms	9	5^+#	12	15Lo04	T	1994	β^-=100;β^-n=1.3 4	*
^{114}Tc^m	−58437	13	160	430	MD*	90	ms	20	1^+#	12	11Ri01	TD	2011	$\beta^-\approx$100;IT ?;β^-n=1.3 4	*
^{114}Ru	−70221	4				540	ms	30	0^+	12	06Mo07	T	1991	β^-=100;β^-n ?;β^-2n ?	*
^{114}Rh	−75710	70			*	1.85	s	0.05	1^+	12			1988	β^-=100	
^{114}Rh^m	−75510#	170#	200#	150#	*	1.85	s	0.05	(7^-)	12			1987	β^-=100	
^{114}Pd	−83490	7				2.42	m	0.06	0^+	12			1958	β^-=100	
^{114}Ag	−84931	5				4.6	s	0.1	1^+	12			1958	β^-=100	
^{114}Ag^m	−84732	5	198.9	1.0		1.50	ms	0.05	(6^+)	12	90Pe10	TED	1990	IT=100	*
^{114}Cd	−90014.93	0.28				STABLE		>92Py	0^+	12	95Ge14	T	1925	IS=28.754 81;2β^- ?	
^{114}In	−88569.8	0.3				71.9	s	0.1	1^+	12			1937	β^-=99.50 15;β^+=0.50 15	
^{114}In^m	−88379.5	0.3	190.2682	0.0008		49.51	d	0.01	5^+*	12			1939	IT=96.75 24;β^+=3.25 24	
^{114}In^n	−88067.9	0.3	501.948	0.003		43.1	ms	0.6	8^-	12			1958	IT=100[gs=0,m=100]	
^{114}Sn	−90559.735	0.029				STABLE			0^+	12			1927	IS=0.66 1	
^{114}Sn^m	−87472.37	0.08	3087.37	0.07		733	ns	14	7^-	12			1980	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{114}Sb	−84497	20				3.49 m	0.03	3^+	12		1959	β^+=100	
^{114}Sb^m	−84002	20	495.5	0.7		219 μs	12	(8^-)	12		1973	IT=100	
^{114}Te	−81890	24				15.2 m	0.7	0^+	12		1968	β^+=100	
^{114}I	−72639	20				2.01 s	0.15	1^+	12	20Ay05 TD	1977	β^+=100;β^+p ?;α≈7.7e-9#	*
^{114}I^m	−72373	20	265.9	0.5		6.2 s	0.5	(7^-)	12		1995	β^+= ?;IT= ?	*
^{114}Xe	−67086	11				10.0 s	0.4	0^+	12		1977	β^+=100	
^{114}Cs	−54690	90				570 ms	20	(1^+)	12		1978	β^+≈100;α=0.018 6; β^+p=8.7 13;$\beta^+\alpha$=0.19 3	
^{114}Ba	−45910	100				460 ms	125	0^+	12	16Ca33 T	1995	β^+≈100;β^+p=20 10;α=0.9 3; 12C<0.0034	*

*^{114}Tc T : average 15Lo04=120(10) 11Ro01=110(20) 99Wa09=150(30) **
*^{114}Tc T : other: 06Mo07=91(+62-35) probably mixture of gs and isomer **
*^{114}Tc D : %β^-n from 99Wa09, value in a mixture of gs and isomer **
*^{114}Tc^m D : %β^-n from 99Wa09, value in a mixture of gs and isomer **
*^{114}Ru T : average 06Mo07=510(+69-65) 92Jo05=530(60) 91Le09=570(50) **
*^{114}Ag^m E : 34.5(0.5), 43.9(0.5), 47.4(0.5), 73.1(0.5) in a cascade to gs in 90Pe10 **
*^{114}I T : average 20Ay05=1.89(0.23) 77Ki11=2.1(0.2) **
*^{114}I^m J : from M3 to (4-) following by E2 to (2)- following by E1 to 1+ **
*^{114}Ba T : average 16Ca33=380(+190-110) 97Ja12=430(+300-150) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{115}Nb	−30880#	500#				23 ms	8	$3/2^-$#	15		2010	β^-=100;β^-n ?;β^-2n ?	
^{115}Mo	−44550#	400#				45.5 ms	2.0	$3/2^+$#	15		2010	β^-=100;β^-n ?;β^-2n ?	
^{115}Tc	−55800#	200#				78 ms	2	$5/2^+$#	15		1994	β^-=100;β^-n ?	
^{115}Ru	−66105	25				318 ms	19	$(1/2^+)$	12		1992	β^-=100;β^-n ?	
^{115}Ru^m	−66110	90	82	6		76 ms	6	$(7/2^-)$	12	10Ku25 ETJ	2010	IT= ?;β^-= ?	*
^{115}Rh	−74229	7				1.03 s	3	$(7/2^+)$	12	92PeZX T	1988	β^-=100;β^-n ?	*
^{115}Pd	−80426	14				25 s	2	$(1/2)^+$	12		1958	β^-=100	
^{115}Pd^m	−80337	14	89.21	0.16		50 s	3	$(7/2^-)$	12		1987	β^-=92.0 20;IT=8.0 20	
^{115}Ag	−84983	18				20.0 m	0.5	$1/2^-$	12		1949	β^-=100	
^{115}Ag^m	−84942	18	41.16	0.10		18.0 s	0.7	$7/2^+$	12		1958	β^-=79.0 3;IT=21.0 3	
^{115}Cd	−88084.5	0.7				53.46 h	0.05	$1/2^+$*	12		1939	β^-=100	*
^{115}Cd^m	−87903.5	0.9	181.0	0.5		44.56 d	0.24	$11/2^-$*	12		1959	β^-≈100;IT ?	*
^{115}In	−89536.357	0.012				441 Ty	25	$9/2^+$*	12		1924	IS=95.719 52;β^-=100	
^{115}In^m	−89200.113	0.021	336.244	0.017		4.486 h	0.004	$1/2^-$*	12		1961	IT=95.0 7;β^-=5.0 7	
^{115}Sn	−90033.846	0.015				STABLE		$1/2^+$*	12		1927	IS=0.34 1	
^{115}Sn^m	−89421.04	0.04	612.81	0.04		3.26 μs	0.08	$7/2^+$	12		1967	IT=100	
^{115}Sn^n	−89320.21	0.12	713.64	0.12		159 μs	1	$11/2^-$	12		1958	IT=100	
^{115}Sb	−87003	16				32.1 m	0.3	$5/2^+$	12		1958	β^+=100	
^{115}Sb^m	−84207	16	2796.26	0.09		159 ns	3	$(19/2)^-$	12		1977	IT=100	
^{115}Te	−82063	28			*	5.8 m	0.2	$7/2^+$	12		1961	β^+=100	
^{115}Te^m	−82053	30	10	6	*	6.7 m	0.4	$(1/2^+)$	12	74Ch51 E	1974	β^+≈100;IT ?	*
^{115}Te^n	−81783	28	280.05	0.20		7.5 μs	0.2	$11/2^-$	12		1972	IT=100	
^{115}I	−76338	29				1.3 m	0.2	$5/2^+$#	12		1969	β^+=100	
^{115}Xe	−68657	12				18 s	3	$(5/2^+)$	12		1969	β^+=100;β^+p=0.34 6	*
^{115}Cs	−59700#	100#				1.4 s	0.8	$9/2^+$#	12		1978	β^+=100;β^+p≈0.07	
^{115}Ba	−48920#	200#				450 ms	50	$5/2^+$#	12	97Ja12 D	1997	β^+=100;β^+p>15	

*^{115}Ru^m E : 20 keV above the 61.7-keV level in 10Ku25 **
*^{115}Rh T : average 92PeZX=1.04(0.03) 88Ay01=0.99(0.05) **
*^{115}Cd J : also 13Yo02=1/2 **
*^{115}Cd^m J : also 13Yo02=11/2 **
*^{115}Te^m E : less than 20 keV in 74Ch51 **
*^{115}Xe T : average 71Ho07=18(4) 69Ha03=19(5) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
^{116}Nb	−25230#	300#				12# ms	>550ns	1^-#		18Sh11 I	2018	β^- ?;β^-n ?;β^-2n ?	
^{116}Mo	−41210#	500#				32 ms	4	0^+	15		2010	β^-=100;β^-n ?;β^-2n ?	
^{116}Tc	−51210#	300#				57 ms	3	2^+#	15		1997	β^-=100;β^-n ?;β^-2n ?	
^{116}Ru	−64069	4				204 ms	6	0^+	15		1994	β^-=100;β^-n ?	
^{116}Rh	−70740	70			*	685 ms	39	1^+	10	06Mo07 TD	1970	β^-=100;β^-n<2.1	*
^{116}Rh^m	−70540#	170#	200#	150#	*	570 ms	50	(6^-)	10	01Wa04 T	1987	β^-=100;β^-n<2.1	*
^{116}Pd	−79831	7				11.8 s	0.4	0^+	10		1970	β^-=100	
^{116}Ag	−82543	3				3.83 m	0.08	(0^-)	10	09Ba52 TJ	1958	β^-=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{116}Ag^m	−82495	3	47.90	0.10		20 s 1	(3$^+$)	10	05Ba94	TJD	2005	β^-=93 4;IT=7 4	
^{116}Ag^n	−82413	3	129.80	0.22		9.3 s 0.3	(6$^-$)	10	05Ba94	TJD	1970	β^-=92 4;IT=8 4	
^{116}Cd	−88712.49	0.16				26.9 Ey 0.9	0$^+$	10	20Ba.A	T	1925	IS=7.512 54;2β^-=100	*
^{116}In	−88249.76	0.22				14.10 s 0.03	1$^+$	10	13Wr01	D	1937	$\beta^-\approx$100;ε=0.0237 43	*
^{116}In^m	−88122.49	0.22	127.267	0.006		54.29 m 0.17	5$^+$*	10			1945	β^-=100	
^{116}In^n	−87960.10	0.22	289.660	0.006		2.18 s 0.04	8$^-$*	10			1950	IT=100[gs=0,m=100]	
^{116}Sn	−91525.98	0.10				STABLE	0$^+$	10			1922	IS=14.54 9	
^{116}Sn^m	−89160.00	0.10	2365.975	0.021		348 ns 19	5$^-$	10			1964	IT=100	
^{116}Sn^n	−87978.82	0.20	3547.16	0.17		833 ns 30	10$^+$	10			1978	IT=100	
^{116}Sb	−86822	5				15.8 m 0.8	3$^+$*	10			1949	β^+=100	
^{116}Sb^m	−86728	5	93.99	0.05		194 ns 4	1$^+$	10			1976	IT=100	
^{116}Sb^n	−86440	40	390	40	BD	60.3 m 0.6	8$^-$*	10			1949	β^+=100	
^{116}Te	−85264	24				2.49 h 0.04	0$^+$	10			1958	β^+=100	
^{116}I	−77420	80				2.91 s 0.15	1$^+$	10			1976	β^+=100	
^{116}I^m	−76990	80	430.4	0.5		3.27 μs 0.16	(7$^-$)	10			1990	IT=100	
^{116}Xe	−73047	13				59 s 2	0$^+$	10			1969	β^+=100	
^{116}Cs	−62040#	100#			*	700 ms 40	(1$^+$)	10	77Bo28	D	1975	β^+=100;β^+p=0.28 7; $\beta^+\alpha$=0.049 25	*
^{116}Cs^m	−61940#	120#	100#	60#	*	3.85 s 0.13	(7$^+$)	10			1975	β^+=100;β^+p=0.44 7; $\beta^+\alpha$=0.0034 23	*
^{116}Ba	−54380#	200#				1.3 s 0.2	0$^+$	10			1997	β^+=100;β^+p=3 1	
^{116}La	−40050#	320#				10# ms		10				β^+ ?;β^+p ?;p ?	*

*^{116}Rh T : average 06Mo07=688(+52-50) 88Ay02=680(60) **
*^{116}Rh D : %β^-n from 06Mo07, a mixture of gs and isomer **
*^{116}Rh^m D : %β^-n from 06Mo07, a mixture of gs and isomer **
*^{116}Ag T : from 09Ba52=230(5) s **
*^{116}Cd T : value for 2ν-$\beta\beta$; others (recent)18Ba44=26.3(0.1,stat)(+1.1-1.2,syst) **
*^{116}Cd T : 17Ar01=27.4(0.4,stat)(1.8,syst) 15Ba11=28.7(1.3) (evaluation) **
*^{116}In D : %ε average 13Wr01=0.0246(44stat)(39syst) 98Bh04=0.0227(0.0063) **
*^{116}In T : also 13Wr01=14.9(0.8) **
*^{116}Cs D : %β^+p from 77Bo28; Ensdf2010=2.8(0.7)% in error **
*^{116}Cs^m D : %β^+p average 77Bo28=0.66(0.13) 78Da07=0.36(0.08)%; Birge ratio=1.97 **
*^{116}Cs^m D : %$\beta^+\alpha$ average 78Da07=0.008(0.002)% and 0.0022(0.0010), from **
*^{116}Cs^m D : %β^+p=0.44(0.07) and β^+p/$\beta^+\alpha$=200(80) in 85Ti02; **
*^{116}Cs^m D : Birge ratio=2.6 **
*^{116}Cs^m J : direct β^+ feedings to 6+ and 8+ levels in ^{116}Xe in 80Ma16 **
*^{116}La T : estimate for β^+ decay; no p decay within 20 us-20 ms **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{117}Mo	−35690#	500#				22 ms 5	3/2$^+$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{117}Tc	−48140#	400#				44.5 ms 3.0	5/2$^+$#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{117}Ru	−59490	430				151 ms 3	3/2$^+$#	15			1994	β^-=100;β^-n ?	
^{117}Ru^m	−59310	430	185.0	0.4		2.49 μs 0.06	7/2$^-$#	15			2012	IT=100	*
^{117}Rh	−68897	9				421 ms 30	7/2$^+$#	11	06Mo07	TD	1991	β^-=100;β^-n<7.6	*
^{117}Rh^m	−68576	9	321.2	1.0		138 ns 17	3/2$^+$#		13La25	ET	2013	IT=100	
^{117}Pd	−76424	7				4.3 s 0.3	(3/2$^+$)	11	04Ur04	J	1968	β^-=100	
^{117}Pd^m	−76221	7	203.3	0.3		19.1 ms 0.7	(9/2$^-$)	11	04Ur04	J	1990	IT=100	
^{117}Ag	−82182	14				73.6 s 1.4	1/2$^-$#	11			1958	β^-=100	*
^{117}Ag^m	−82153	14	28.6	0.2		5.34 s 0.05	7/2$^+$#	11			1990	β^-=94.0 15;IT=6.0 15	*
^{117}Cd	−86418.4	1.0				2.503 h 0.005	1/2$^+$*	11	19Gi09	T	1939	β^-=100	*
^{117}Cd^m	−86282.0	1.0	136.4	0.2		3.441 h 0.009	11/2$^-$*	11	19Gi09	T	1966	β^-=100	*
^{117}In	−88943	5				43.2 m 0.3	9/2$^+$*	11			1937	β^-=100	
^{117}In^m	−88628	5	315.303	0.011		116.2 m 0.3	1/2$^-$*	11			1940	β^-=52.9 15;IT=47.1 15	
^{117}Sn	−90397.7	0.5				STABLE	1/2$^+$*	11	20Yo.A	J	1923	IS=7.68 7	
^{117}Sn^m	−90083.1	0.5	314.58	0.04		13.939 d 0.024	11/2$^-$*	12	20Yo.A	J	1950	IT=100	*
^{117}Sn^n	−87991.3	0.6	2406.4	0.4		1.75 μs 0.07	(19/2$^+$)	11			1979	IT=100	
^{117}Sb	−88640	8				2.97 h 0.02	5/2$^+$*	11	21Da02	T	1947	β^+=100	
^{117}Sb^m	−85509	8	3130.76	0.19		355 μs 17	(25/2)$^+$	11			1970	IT=100	
^{117}Sb^n	−85409	8	3230.7	0.2		290 ns 5	(23/2$^-$)	11			1987	IT=100	
^{117}Te	−85096	13				62 m 2	1/2$^+$*	11			1958	β^+=100;ε=75 1;e$^+$=25 1	
^{117}Te^m	−84800	13	296.1	0.5		103 ms 3	(11/2$^-$)	11	99Mo30	J	1963	IT=100	
^{117}I	−80439	26				2.22 m 0.04	(5/2)$^+$	11			1969	β^+=100;e$^+\approx$77	
^{117}Xe	−74185	10				61 s 2	5/2$^+$*	11	90NeZY	J	1969	β^+=100;β^+p=0.0029 6	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{117}Cs	−66490	60				*	8.4 s 0.6	$9/2^+$#	11			1972	β^+=100	
^{117}Cs^m	−66340#	100#	150#	80#		*	6.5 s 0.4	$3/2^+$#	11			1978	β^+=100	
^{117}Cs^x	−66440	80	50	50			R=?	*spmix*						
^{117}Ba	−57460	250					1.75 s 0.07	$(3/2^+)$	11	97Ja12	D	1977	β^+=100;β^+p=13 3; $\beta^+\alpha$=0.024 8	*
^{117}La	−46270#	200#					21.7 ms 1.8	$(3/2^+)$	11	11Li28	TJ	2001	p≈100;β^+ ?;β^+p ?	*
^{117}La^m			*non−exist*		RN		10 ms 5	$(9/2^+)$	11	01So02	I			*

*^{117}Ru^m T : symmetrized from 12Ka36=2.487(+0.058-0.055); other 12LaZT=2.0(0.3) **
*^{117}Rh T : average 06Mo07=394(+47-43) 91Pe10=440(40) **
*^{117}Ag T : symmetrized from 72.8(+2.0-0.7) **
*^{117}Ag^m J : E3 to 1/2-# **
*^{117}Cd J : 13Yo02=1/2 **
*^{117}Cd^m J : 13Yo02=11/2 **
*^{117}Sn^m T : average 16Do10=13.91(0.03) 14Un01=14.00 (0.05) 03Po21=13.98 (0.07) **
*^{117}Xe J : 90NeZY=5/2 **
*^{117}Ba D : %β^+p from 97Ja12. β^+p/$\beta^+\alpha$=350-1200 from 85Ti02 yields **
*^{117}Ba D : %$\beta^+\alpha$=0.011%-0.037% **
*^{117}La T : average 11Li28=20.1(2.5) 01Ma69=24(3) 01So02=22(5) **
*^{117}La^m I : reported in 01So02 with E=121(10) keV, but not confirmed in 11Li28 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{118}Mo	−32370#	500#					21 ms 6	0^+	15	15Lo04	TD	2015	β^-=100;β^-n ?;β^-2n ?	*
^{118}Tc	−43290#	400#					30 ms 4	2^+#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{118}Ru	−57000#	200#					99 ms 3	0^+	15			1994	β^-=100;β^-n ?	
^{118}Rh	−64887	24				*	282 ms 9	1^+#	06	15Lo04	T	1994	β^-=100;β^-n=3.1 14	*
^{118}Rh^m	−64690#	150#	200#	150#		*	310 ms 30	6^-#	06	00Jo18	T	1994	β^-≈100;IT ?;β^-n=3.1 14	*
^{118}Pd	−75388.4	2.5					1.9 s 0.1	0^+	06			1969	β^-=100	
^{118}Ag	−79553.8	2.5					3.76 s 0.15	(2^-)	95	93Ja03	J	1967	β^-=100	
^{118}Ag^m	−79508.0	2.5	45.79	0.09			∼0.1 μs	$(1,2)^-$	95	93Ja03	J	1989	IT=100	
^{118}Ag^n	−79426.2	2.5	127.63	0.10			2.0 s 0.2	(5^+)	95	FGK208	JD	1971	β^-=59 3;IT=41 3	*
^{118}Ag^p	−79274.4	2.5	279.37	0.20			∼0.1 μs	(3^+)	95	93Ja03	TJ	1989	IT=100	
^{118}Cd	−86702	20					50.3 m 0.2	0^+	95			1961	β^-=100	
^{118}In	−87228	8				*	5.0 s 0.5	1^+	95			1949	β^-=100	
^{118}In^m	−87130#	50#	100#	50#		*	4.364 m 0.007	5^+*	95	94It.A	T	1964	β^-=100	
^{118}In^n	−86990#	50#	240#	50#			8.5 s 0.3	8^-*	95			1969	IT=98.6 3[gs=0,m=98.6]; β^-=1.4 3	*
^{118}Sn	−91652.8	0.5					STABLE	0^+	95			1924	IS=24.22 9	
^{118}Sn^m	−89077.9	0.5	2574.91	0.04			230 ns 10	7^-	95			1961	IT=100	
^{118}Sn^n	−88544.7	0.5	3108.06	0.22			2.52 μs 0.06	(10^+)	95	11Fo15	J	1973	IT=100	
^{118}Sb	−87996	3					3.6 m 0.1	1^+*	95			1947	β^+=100	
^{118}Sb^m	−87945	3	50.814	0.021			20.6 μs 0.6	3^+	95			1975	IT=100	*
^{118}Sb^n	−87746	5	250	6	BD		5.01 h 0.03	8^-*	95	21Da02	T	1947	β^+=100	*
^{118}Te	−87691	18					6.00 d 0.02	0^+	95			1948	ε=100	
^{118}I	−80971	20					13.7 m 0.5	(2^-)	95			1957	β^+=100	
^{118}I^m	−80782	20	188.8	0.7			8.5 m 0.5	(7^-)	95	03Mo36	E	1968	β^+≈100;IT ?	*
^{118}Xe	−78079	10					3.8 m 0.9	0^+	95			1965	β^+=100	
^{118}Cs	−68409	13				*	14 s 2	2^+*	95			1969	β^+=100;β^+p=0.021 14; $\beta^+\alpha$=0.0012 5	*
^{118}Cs^m	−68310#	60#	100#	60#		*	17 s 3	(7^-)	95	93Be46	J	1972	β^+=100;β^+p=0.021 14; $\beta^+\alpha$=0.0012 5	
^{118}Cs^x	−68404	12	5	4			$R<0.1$	*spmix*						
^{118}Ba	−62200#	200#					5.2 s 0.2	0^+	06	97Ja12	T	1997	β^+=100	
^{118}La	−49620#	300#					200# ms	1^-#					β^+ ?;β^+p ?	

*^{118}Mo T : symmetrized from 15Lo04=19(+7-4) **
*^{118}Rh T : average 15Lo04=285(10) 06Mo07=266(+22-21) from β^-(t); probably contain **
*^{118}Rh T : contributions from both the low- and high-spin β^- decaying states **
*^{118}Rh J : direct β^- feeding to 0+ state in ^{118}Pd in 06Wa10 **
*^{118}Rh D : %β^-n from 06Mo07, probably a mixture of gs and isomer **
*^{118}Rh^m T : from $\beta-\gamma$(t) using 575-keV gamma ray, depopulating the 4+ **
*^{118}Rh^m T : level in ^{118}Pd, in 00Jo18; most-likely dominated by the **
*^{118}Rh^m T : high-spin β^- decaying state **
*^{118}Rh^m J : direct β^- feeding to 6- level in ^{118}Pd in 06Wa10 **
*^{118}Rh^m D : %β^-n from 06Mo07, probably a mixture of gs and isomer **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{118}$Ag^{n}	J : 127.6-keV gamma-ray E3 to (2-)														**
$*^{118}$Ag^{n}	D : from Ig(127keV,^{118}Ag)/Ig(48 keV,^{118}Cd)=0.124(0.015) in 73FoZF														**
$*^{118}$In^{n}	E : 138.2(0.5) keV above ^{118}In^{m}														**
$*^{118}$Sb^{m}	J : E2 to 1+														**
$*^{118}$Sb^{n}	T : average 21Da02=5.18(0.05) 74Ca06=5.00(0.02) 72Pa13=5.11(0.06)														**
$*^{118}$Sb^{n}	T : 68Ki06=5.15(0.05) 67Ha27=4.96(0.02); Birge ratio=2.68														**
$*^{118}$I^{m}	E : from a least-squares fit to level scheme of 03Mo36														**
$*^{118}$Cs	D : from %β^+p=0.042(6), %$\beta^+\alpha$=0.0024(4) for mixture of gs and isomer														**
^{119}Mo	−26580#	300#				12#	ms	>550ns	3/2$^+$#		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{119}Tc	−40170#	500#				22	ms	3	5/2$^+$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{119}Ru	−52080#	300#				69.5	ms	2.0	3/2$^+$#	15			1997	β^-=100;β^-n ?;β^-2n ?	
^{119}Ru^{m}	−51850#	300#	227.1	0.7		384	ns	22		15			2012	IT=100	*
^{119}Rh	−62823	9				190	ms	6	7/2$^+$#	09	15Lo04	T	1994	β^-=100;β^-n=6.4 16	
^{119}Pd	−71407	8				920	ms	80	3/2$^+$#	09	06Mo07	TD	1991	β^-=100;β^-n ?	*
^{119}Pd^{m}	−71110#	150#	300#	150#		3#	ms		11/2$^-$#					IT ?;β^- ?	
^{119}Ag	−78646	15			*&	6.0	s	0.5	1/2$^-$#	09			1975	β^-=100	
^{119}Ag^{m}	−78626#	25#	20#	20#	*&	2.1	s	0.1	7/2$^+$#	09			1975	β^-=100	*
^{119}Cd	−83980	40				2.69	m	0.02	1/2$^+$*	09	13Yo02	J	1961	β^-=100	
^{119}Cd^{m}	−83830	40	146.54	0.11		2.20	m	0.02	11/2$^-$*	09	13Yo02	J	1974	β^-=100	
^{119}In	−87699	7				2.4	m	0.1	9/2$^+$*	09			1949	β^-=100	
^{119}In^{m}	−87388	7	311.37	0.03		18.0	m	0.3	1/2$^-$*	09	76Sc30	D	1973	β^-=97.4 4;IT=2.6 4	*
^{119}In^{n}	−87045	7	654.27	0.07		130	ns	15	(3/2)$^+$	09			1974	IT=100	
^{119}In^{p}	−85042	7	2656.9	1.8		265	ns	10	(25/2$^+$)	09	20Bi06	T	2002	IT=100	*
^{119}Sn	−90065.0	0.7				STABLE			1/2$^+$*	09			1925	IS=8.59 4	
^{119}Sn^{m}	−89975.5	0.7	89.531	0.013		293.1	d	0.7	11/2$^-$*	09	20Yo.A	J	1950	IT=100	
^{119}Sn^{n}	−87938.0	1.2	2127.0	1.0		9.6	μs	1.2	(19/2$^+$)	09			1992	IT=100	
^{119}Sn^{p}	−87696.0	0.8	2369.0	0.3		96	ns	9	23/2$^+$		16Is03	ETJ	2016	IT=100	
^{119}Sb	−89476	7				38.19	h	0.22	5/2$^+$*	09			1947	ε=100	
^{119}Sb^{m}	−86922	7	2553.6	0.3		130	ns	3	19/2$^-$	09	91Io02	J	1991	IT=100	
^{119}Sb^{n}	−86634	7	2841.7	0.4		835	ms	81	25/2$^+$	09	19Mi18	ET	1979	IT=100	*
^{119}Te	−87183	7				16.05	h	0.05	1/2$^+$*	09			1948	β^+=100;ε=97.94 5; e$^+$=2.06 5	
^{119}Te^{m}	−86922	7	260.96	0.05		4.70	d	0.04	11/2$^-$*	09			1960	β^+=100;ε=99.59 4; e$^+$=0.41 4	
^{119}I	−83778	22				19.1	m	0.4	5/2$^+$	09			1954	β^+=100;e$^+$=51 4;ε=49 4	
^{119}Xe	−78794	10				5.8	m	0.3	5/2$^+$*	09	90NeZY	J	1965	β^+=100;e$^+$=79 5;ε=21 5	*
^{119}Cs	−72305	14			*	43.0	s	0.2	9/2$^+$*	09	75Ho09	D	1969	β^+=100;$\beta^+\alpha$<2e-6	
^{119}Cs^{m}	−72260#	30#	50#	30#	*	30.4	s	0.1	3/2$^+$*	09			1978	β^+=100	
^{119}Cs^{x}	−72289	9	16	11		$R=0.50$		0.25	*spmix*						
^{119}Ba	−64590	200				5.4	s	0.3	(5/2$^+$)	09			1974	β^+=100;β^+p=25 2	
^{119}La	−55020#	300#				1#	s		11/2$^-$#					β^+ ?	
^{119}Ce	−43820#	500#				200#	ms		5/2$^+$#					β^+ ?;β^+p ?	
$*^{119}$Ru^{m}	T : symmetrized from 12Ka36=383(+22-21)														**
$*^{119}$Pd	T : average 06Mo07=918(111) 91Pe04=920(130)														**
$*^{119}$Ag^{m}	E : estimated from 7/2+ levels in ^{113}Ag=43 keV ^{115}Ag=41 keV and														**
$*^{119}$Ag^{m}	E : ^{117}Ag=28 keV														**
$*^{119}$In^{m}	D : %IT symmetrized from 76Sc30=2.5(+0.5-0.3); other 61Gl06∼5														**
$*^{119}$In^{p}	T : average 20Bi06=270(11) 02Lu15=240(25)														**
$*^{119}$Sb^{n}	T : average 19Mi18=776(181) 79Sh03=850(90)														**
$*^{119}$Sb^{n}	E : based on 19Mi18=2799(30) keV and known states in ^{119}Sn see 87Lu06;														**
$*^{119}$Sb^{n}	E : other Ensdf2009=x keV above 2841.7(0.4)-keV level, conflicting														**
$*^{119}$Sb^{n}	J : from 87Lu06														**
$*^{119}$Xe	J : 90NeZY=5/2														**
^{120}Tc	−35000#	500#				21	ms	5	3$^+$#	17			2010	β^-=100;β^-n ?;β^-2n ?	
^{120}Ru	−49720#	400#				45	ms	2	0$^+$	17			2010	β^-=100;β^-n ?	
^{120}Rh	−58620#	200#				129.6	ms	4.2	8$^-$#	17	15Lo04	T	1994	β^-=100;β^-n<9.3;β^-2n ?	*
^{120}Rh^{m}	−58460#	200#	157.2	0.7		295	ns	16	6#	17	12Ka36	ETD	2012	IT=100	*
^{120}Pd	−70279.6	2.3				492	ms	33	0$^+$	17	06Mo07	TD	1993	β^-=100;β^-n<0.7	
^{120}Ag	−75652	4			*	1.52	s	0.07	4($^+$)	02	12Ba58	TJ	1971	β^-=100;β^-n<0.003	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J$^\pi$	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{120}Ag^m	−75650#	50#	0#	50#	*	940 ms 100	$(0^-,1^-)$		12Ba58	TJD	2012	β^-=?;IT ?;β^-n ?	
^{120}Ag^n	−75449	4	203.2	0.2		384 ms 22	$7(^-)$	02	12Ba58	EJD	1971	IT=68 10;β^-=32 10;β^-n ?	*
^{120}Cd	−83957	4				50.80 s 0.21	0^+	02			1973	β^-=100	
^{120}In	−85730	40			*	3.08 s 0.08	1^+	02			1958	β^-=100	
^{120}In^m	−85680#	50#	50#	60#	*&	46.2 s 0.8	5^+*	02			1960	β^-=100	
^{120}In^n	−85430#	200#	300#	200#	*&	47.3 s 0.5	8^-*	02			1960	β^-=100	
^{120}Sn	−91097.7	0.9				STABLE	0^+	02			1926	IS=32.58 9	
^{120}Sn^m	−88616.1	0.9	2481.63	0.06		11.8 μs 0.5	7^-	02			1960	IT=100	
^{120}Sn^n	−88195.5	0.9	2902.22	0.22		6.26 μs 0.11	10^+	02	FGK128	J	1987	IT=100	*
^{120}Sb	−88417	7			*	15.89 m 0.04	1^+*	02			1937	β^+=100	
^{120}Sb^m	−88420#	100#	0#	100#	*	5.76 d 0.02	8^-*	02			1958	β^+=100	
^{120}Sb^n	−88339	7	78.16	0.05		246 ns 2	(3^+)	02			1976	IT=100	
^{120}Sb^p	−86090#	100#	2328#	100#		400 ns 8	13^+	02			1983	IT=100	*
^{120}Te	−89362.2	1.8				STABLE >1.6Zy	0^+	02	18Al23	T	1936	IS=0.09 1;2β^+ ?	
^{120}I	−83747	15				81.67 m 0.18	2^-	02	06Ph01	T	1957	β^+=100	*
^{120}I^m	−83674	15	72.61	0.09		242 ns 5	3^+	02	11Mo27	TJ	1974	IT=100	*
^{120}I^n	−83430	150	320	150	BD	53 m 4	(7^-)	02			1967	β^+=100	
^{120}Xe	−82172	12				46.0 m 0.6	0^+	02	06Ph01	T	1965	β^+=100	
^{120}Cs	−73889	10			*	60.4 s 0.6	2^+*	02	06Ph01	T	1969	β^+=100;$\beta^+\alpha$<2.0e-5 4; β^+p<7e-6 3	*
^{120}Cs^m	−73790#	60#	100#	60#	*	57 s 6	(7^-)	02	75Ho09	D	1977	β^+=100;$\beta^+\alpha$<2.0e-5 4; β^+p<7e-6 3	*
^{120}Cs^x	−73884	9	5	4		$R<0.1$	*spmix*						
^{120}Ba	−68890	300				24 s 2	0^+	02	92Xu04	T	1974	β^+=100	
^{120}La	−57570#	300#				2.8 s 0.2	1^-#	02			1984	β^+=100;β^+p=?	
^{120}Ce	−49730#	500#				250# ms	0^+					β^+ ?;β^+p ?	

*^{120}Rh T : average 15Lo04=131(5) 06Mo07=136(+14-13)) 04Wa26=120(10) **
*^{120}Rh D : %β^-n from 20Sh.A<8.9(0.4); other 06Mo07<5.4 **
*^{120}Rh^m E : 12Ka36=59.1(0.5) and 98.1(0.5) gamma rays in a cascade to gs **
*^{120}Rh^m T : symmetrized from 12Ka36=294(+16-15) **
*^{120}Ag T : others 83Re05=1.25(0.03) 71Fo22=1.17(0.05) not used (outliers) **
*^{120}Ag D : %β^-n from 83Re05 **
*^{120}Ag^n T : average 12Ba58=440(50) 03Wa13=400(30) 71Fo22=320(40) **
*^{120}Ag^n J : 203 keV E3 gamma-ray to 4(+) **
*^{120}Sn^n J : 67.2-keV gamma-ray depopulating transition E2 to 8+ **
*^{120}Sb^p E : 2328.3(0.6) keV above ^{120}Sb^m **
*^{120}I T : average 06Ph01=82.1(0.6) 00Ho19=81.7(0.2) 65An05=81.0(0.6) **
*^{120}I^m T : average 11Mo27=244(5) 74Mu10=228(15) **
*^{120}Cs T : average 06Ph01=60.0(7) 93Al03=60(2) 77Ge03=64(3) 69Ch18=61.3(1.4) **
*^{120}Cs D : %$\beta^+\alpha$ and %β^+p are for both the gs and isomer in 75Ho09 **
*^{120}Cs^m D : %$\beta^+\alpha$ and %β^+p are for both the gs and isomer in 75Ho09 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J$^\pi$	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{121}Tc	−31540#	500#				22 ms 6	$5/2^+$#	15			2015	β^-=100;β^-n ?;β^-2n ?	
^{121}Ru	−44620#	400#				29 ms 2	$3/2^+$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{121}Rh	−56250	620				74 ms 4	$7/2^+$#	10	15Lo04	T	1994	β^-=100;β^-n>11	*
^{121}Pd	−66182	3				290 ms 1	$3/2^+$#	10	15Lo04	T	1994	β^-=100;β^-n<0.8	*
^{121}Pd^m	−66047	3	135.5	0.5		460 ns 90	$7/2^+$#	10	12Ka36	ETD	2007	IT=100	*
^{121}Pd^n	−66022	14	160	14		460 ns 90	$11/2^-$#		12Ka36	ETD	2007	IT=100	*
^{121}Ag	−74403	12			*	777 ms 10	$7/2^+$#	10	83Re05	D	1982	β^-=100;β^-n=0.080 13	*
^{121}Ag^m	−74383#	23#	20#	20#	*	200# ms	$1/2^-$#					β^- ?;IT ?;β^-n ?	
^{121}Cd	−81073.8	1.9				13.5 s 0.3	$3/2^+*$	10	13Yo02	J	1965	β^-=100	
^{121}Cd^m	−80858.9	1.9	214.86	0.15		8.3 s 0.8	$11/2^-*$	10	13Yo02	J	1982	β^-=100	
^{121}In	−85835	27				23.1 s 0.6	$9/2^+*$	10			1960	β^-=100	
^{121}In^m	−85521	27	313.68	0.07		3.88 m 0.10	$1/2^-*$	10			1974	β^-=98.8 2;IT=1.2 2	
^{121}In^n	−83290#	100#	2550#	100#		7.3 μs 2	$(25/2^+)$		20Bi06	TDJ	2002	IT=100	*
^{121}Sn	−89196.6	1.0				27.03 h 0.04	$3/2^+*$	10			1948	β^-=100	
^{121}Sn^m	−89190.3	1.0	6.31	0.06		43.9 y 0.5	$11/2^-*$	10			1962	IT=77.6 20;β^-=22.4 20	
^{121}Sn^n	−87197.9	1.0	1998.68	0.13		5.3 μs 0.5	$19/2^+$	10	16Is03	E	1995	IT=100	*
^{121}Sn^p	−86974.6	1.0	2222.0	0.2		520 ns 50	$23/2^+$		16Is03	EJT	2012	IT=100	*
^{121}Sn^q	−86362.7	1.0	2833.9	0.2		167 ns 25	$27/2^-$	10	16Is03	EJ	1995	IT=100	*
^{121}Sb	−89599.2	2.5				STABLE	$5/2^+*$	10			1922	IS=57.21 5	
^{121}Sb^m	−86848	17	2751	17		179 μs 6	$(25/2^+)$	10	09Wa02	EJ	2008	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{121}Te	−88543	26				19.31 d 0.07	1/2+	10	19Jo03	T	1939	β+=100	*
^{121}Te^m	−88249	26	293.974	0.022		164.7 d 0.5	11/2−	10	19Jo03	T	1940	IT=88.6 11;β+=11.4 11	*
^{121}I	−86246	5				2.12 h 0.01	5/2+*	10			1950	β+=100	
^{121}I^m	−83869	5	2376.9	0.4		9.0 μs 1.4	21/2+#	10			1982	IT=100	
^{121}Xe	−82481	10				40.1 m 2.0	5/2+*	10	90NeZY	J	1952	β+=100	*
^{121}Cs	−77102	14				155 s 4	3/2+*	10			1969	β+=100	
^{121}Cs^m	−77034	14	68.5	0.3		122 s 3	9/2+*	10	91Ge02	D	1981	β+≈83;IT≈17	
^{121}Cs^x	−77056	16	46	8		$R=2$ 1	*spmix*						
^{121}Ba	−70740	140				29.7 s 1.5	5/2+*	10	75Bo11	D	1975	β+=100;β+p=0.02 1	*
^{121}La	−62190#	300#				5.3 s 0.2	11/2−#	10			1988	β+=100;β+p ?	
^{121}Ce	−52690#	400#				1.1 s 0.1	5/2(+#)	10			1997	β+=100;β+p≈1	
^{121}Pr	−41550#	500#				12 ms 5	(3/2)(+#)	10			2005	p≈100	*

*^{121}Rh T : average 15Lo04=76(5) 20Sh.A=71(7) **
*^{121}Rh D : %β^-n from 20Sh.A>11.5(0.6) **
*^{121}Pd T : other 06Mo07=285(24) **
*^{121}Pd^m T : symmetrized from 12Ka36=460(+85-92) assuming two isomers in a cascade; **
*^{121}Pd^m T : other 12LaZT=630(50) assuming a single-decaying isomer **
*^{121}Pd^n T : symmetrizedfrom 12Ka36=463(+83-94) assuming two isomers in a cascade; **
*^{121}Pd^n E : x keV above ^{121}Pd^m, with x<50 keV estimated by nubase **
*^{121}Ag T : average 06Mo07=661(+75-72) 83Re05=780(10); others 82Fo10=720(100) **
*^{121}Ag T : 95Fe12=1043(80) **
*^{121}In^n T : others (not used) 10Re01=17(2)us 02Lu15=350(50)ns **
*^{121}Sn^n E : from a least-squares fit to the level scheme in 16Is03 **
*^{121}Sn^p E : from a least-squares fit to the level scheme in 16Is03 **
*^{121}Sn^q E : from a least-squares fit to the level scheme in 16Is03; other **
*^{121}Sn^q E : 2832.7(0.5) from a least-squares fit to the level scheme in 12As05 **
*^{121}Sb^m E : x keV above the 2721.6(0.4) level with x<60 in 08Jo03 **
*^{121}Te T : average 19Jo03=19.38(0.03) 08Ea01=19.2 (0.1) 95Si30=19.16(0.05); **
*^{121}Te T : Birge ratio=2.8 **
*^{121}Te^m T : average 19Jo03=165.1(0.7) 08Ea01=164.2 (0.8) **
*^{121}Xe J : 90NeZY=5/2 **
*^{121}Ba J : 88We14=5/2 **
*^{121}Pr T : symmetrized from 05Ro19=10(+6-3) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{122}Tc	−26310#	300#				13# ms >550ns	1+#		18Sh11	I	2018	β− ?;β−n ?;β−2n ?	
^{122}Ru	−41780#	500#				25 ms 1	0+	15			2010	β−=100;β−n ?;β−2n ?	
^{122}Rh	−51880#	300#				51 ms 6	7−#	13	15Lo04	T	1997	β−=100;β−n<3.9;β−2n ?	*
^{122}Rh^m	−51610#	300#	271.0	0.7		830 ns 120	4+#	13	12Ka36	ETD	2012	IT=100	*
^{122}Pd	−64616	20				193 ms 5	0+	14	15Lo04	T	1994	β−=100;β−n<2.5	*
^{122}Ag	−71110	40			*	529 ms 13	(3+)	07			1978	β−=100;β−n=0.186 10	*
^{122}Ag^m	−71030#	60#	80#	50#	*	550 ms 50	(1−)	07			2000	β−=100;IT ?;β−n=?	*
^{122}Ag^n	−71030#	60#	80#	50#	*	200 ms 50	(9−)	07	95Za01	D	2000	β−=100;IT ?;β−n ?	*
^{122}Ag^p	−70940#	60#	171#	50#		6.3 μs 1.0	(1+)		13La11	TJE	2013	IT=100	*
^{122}Cd	−80612.4	2.3				5.24 s 0.03	0+	07			1973	β−=100	
^{122}In	−83570	50			*	1.5 s 0.3	1+	07			1963	β−=100	
^{122}In^m	−83530#	80#	40#	60#	*	10.3 s 0.6	5+*	07			1979	β−=100	
^{122}In^n	−83280	130	290	140	BD	10.8 s 0.4	8−*	07			1979	β−=100	
^{122}Sn	−89940.0	2.4				STABLE	0+	07			1928	IS=4.63 3;2β− ?	*
^{122}Sn^m	−87531.0	2.4	2409.03	0.04		7.5 μs 0.9	7−	07			1979	IT=100	
^{122}Sn^n	−87174.5	2.4	2765.5	0.3		62 μs 3	10+	07	14Is04	EJ	1992	IT=100	*
^{122}Sn^p	−85218.8	2.4	4721.2	0.3		139 ns 9	15−		14Is04	EJT	2012	IT=100	*
^{122}Sb	−88334.2	2.5				2.7238 d 0.0002	2−*	07			1939	β−=97.59 12;β+=2.41 12	
^{122}Sb^m	−88272.8	2.5	61.4131	0.0005		1.86 μs 0.08	3+	07			1962	IT=100	
^{122}Sb^n	−88196.7	2.5	137.4726	0.0008		530 μs 30	5+	07			1963	IT=100	
^{122}Sb^p	−88170.6	2.5	163.5591	0.0017		4.191 m 0.003	8−	07			1947	IT=100	
^{122}Te	−90313.3	1.4				STABLE	0+	07			1932	IS=2.55 12	
^{122}I	−86079	5				3.63 m 0.06	1+	07	12At01	D	1950	β+=100;e+=78 2;ε=22 2	*
^{122}I^m	−85764	5	314.9	0.4		193.3 ns 0.9	7−	07	19Mo28	TJ	2004	IT=100	
^{122}I^n	−85700	5	379.4	0.5		79.1 μs 1.2	7−	07	19Mo28	TJ	2004	IT=100	
^{122}I^p	−85685	5	394.1	0.5		78.2 μs 0.4	(8+)	07	19Mo28	TJ	2004	IT=100	
^{122}I^q	−85635	5	444.1	0.5		146.5 ns 1.2	8−	07	19Mo28	TJ	2004	IT=100	
^{122}Xe	−85355	11				20.1 h 0.1	0+	07			1952	ε=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{122}Cs	−78140	30				21.18	s	0.19	1^+*	07	75Ho09	D	1969	β^+=100;$\beta^+\alpha$<2e-7	
^{122}Cs^m	−78090	30	45.87	0.12		> 1	μs		3^+	07			1987	IT=100	
^{122}Cs^n	−78005	9	140	30	MD	3.70	m	0.11	8^-*	07			1969	β^+=100	
^{122}Cs^p	−78010	30	127.07	0.16		360	ms	20	5^-	07			1969	IT=100	
^{122}Cs^x	−78130	30	14	7		$R=0.10$		0.05	*spmix*						
^{122}Ba	−74609	28				1.95	m	0.15	0^+	07			1974	β^+=100	
^{122}La	−64540#	300#				8.6	s	0.5	(1^-)	07			1984	β^+=100;β^+p=?	*
^{122}Ce	−57870#	400#				2#	s		0^+	07			2005	β^+ ?;β^+p ?	
^{122}Pr	−44780#	500#				500#	ms							β^+ ?;β^+p ?	

*^{122}Rh D : %β^-n from 20Sh.A<3.87(6) **
*^{122}Rh^m E : 12Ka36=63.9(0.5) and 207.1(0.5) gamma rays in a cascade to gs **
*^{122}Rh^m T : symmetrized from 12Ka36=820(+130-110) **
*^{122}Pd T : average 15Lo04=195(5) 06Mo07=175(16) **
*^{122}Ag D : %β^-n from 83Re05, probably includes gs and isomers **
*^{122}Ag^m D : β^-n was observed by 00Kr18, but it was not quantified **
*^{122}Ag^n J : direct β^- decay feeding of 8- level in ^{122}Cd in 95Za01; **
*^{122}Ag^n J : 00Kr18=9 from hfs **
*^{122}Ag^p E : 91-keV above ^{122}Ag^m in 13La11 **
*^{122}Sn T : 0nu-BB 18No01>13 Ty **
*^{122}Sn^n E : from a least-squares fit to the level scheme of 14Is04; other **
*^{122}Sn^n E : 2765.3(0.4) from a least-squares fit to the level scheme of 12As05 **
*^{122}Sn^n T : other 17Ki09=60.8(+8.3-7.0) **
*^{122}Sn^p T : average 14Is04=134(12) 12As05=146(15) **
*^{122}Sn^p E : from a least-squares fit to the level scheme in 14Is04; other **
*^{122}Sn^p E : 4720.2(0.45) from a least-squares fit to the level scheme in 12As05 **
*^{122}I T : others 12At01=4.15(+0.30-0.25) for ^{122}I^{+53} and **
*^{122}I T : 3.13(+0.15-0.13) for ^{122}I^{+52} **
*^{122}La J : significant direct β^+ feeding to 2+ in ^{122}Ba in 92Mo13 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{123}Ru	−36550#	500#				19	ms	2	$3/2^+$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{123}Rh	−49190#	400#				42	ms	4	$7/2^+$#	15	20Sh.A	D	2010	β^-=100;β^-n>24;β^-2n ?	
^{123}Pd	−60430	790				108	ms	1	$3/2^+$#	15	14SmZZ	TD	1994	β^-=100;β^-n=10 6	*
^{123}Pd^m	−60330#	790#	100#	50#		100#	ms		$11/2^-$#	15	19Ch24	ID	2019	$\beta^-\approx$100; IT ?	
^{123}Ag	−69570	30				294	ms	5	$(7/2^+)$*	17	06Mo07	TD	1976	β^-=100;β^-n=0.56 5	*
^{123}Ag^m	−69510	30	59.5	0.5		100#	ms		$(1/2^-)$*		19Ch24	E	2019	β^-=100;β^-n ?	*
^{123}Ag^n	−68120#	30#	1450#	14#		202	ns	20		17	13La11	ETD	2013	IT=100	*
^{123}Ag^p	−68100	30	1472.8	0.8		393	ns	16	$(17/2^-)$	17	13La11	ET	2009	IT=100	*
^{123}Cd	−77414.2	2.7				2.10	s	0.02	$3/2^+$*	04	13Yo02	J	1983	β^-=100	
^{123}Cd^m	−77271	3	143	4		1.82	s	0.03	$11/2^-$*	04	13Yo02	J	1986	β^-=?;IT ?	
^{123}In	−83429	20				6.17	s	0.05	$9/2^+$*	04			1960	β^-=100	
^{123}In^m	−83102	20	327.21	0.04		47.4	s	0.4	$1/2^-$*	04			1960	β^-=100	
^{123}In^n	−81351	20	2078.1	0.6		1.4	μs	0.2	$(17/2^-)$		04Sc42	ETJ	2004	IT=100	*
^{123}In^p	−81326#	24#	2103#	14#		> 100	μs		$(21/2^-)$	10	10Re01	EJT	2010	IT=100	*
^{123}Sn	−87814.7	2.5				129.2	d	0.4	$11/2^-$*	04			1948	β^-=100	
^{123}Sn^m	−87790.1	2.5	24.6	0.4		40.06	m	0.01	$3/2^+$*	04			1948	β^-=100	
^{123}Sn^n	−85869.8	2.5	1944.90	0.12		7.4	μs	2.6	$19/2^+$	04	16Is03	EJ	1992	IT=100	
^{123}Sn^p	−85662.0	2.5	2152.66	0.19		6	μs		$23/2^+$	04	16Is03	EJ	1994	IT=100	
^{123}Sn^q	−85102.2	2.5	2712.47	0.21		34	μs		$27/2^-$	04	16Is03	EJ	1994	IT=100	
^{123}Sb	−89222.9	1.4				STABLE			$7/2^+$*	04			1922	IS=42.79 5	
^{123}Sb^m	−86985.1	1.4	2237.8	0.3		214	ns	3	$19/2^-$		09Wa02	ETJ	2005	IT=100	*
^{123}Sb^n	−86609.5	1.5	2613.4	0.4		65	μs	1	$23/2^+$		09Wa02	ETJ	2007	IT=100	*
^{123}Te	−89171.0	1.4				STABLE		>2Py	$1/2^+$*	04	03Al02	T	1932	IS=0.89 3;ε=100	
^{123}Te^m	−88923.5	1.4	247.47	0.04		119.2	d	0.1	$11/2^-$	04			1951	IT=100	
^{123}I	−87943	4				13.2232	h	0.0015	$5/2^+$*	04	FGK209	T	1949	β^+=100	
^{123}Xe	−85248	10				2.08	h	0.02	$1/2^+$*	04	90NeZY	J	1952	β^+=100	*
^{123}Xe^m	−85063	10	185.18	0.11		5.49	μs	0.26	$7/2^-$	04			1981	IT=100	
^{123}Cs	−81044	12				5.88	m	0.03	$1/2^+$*	04			1954	β^+=100	
^{123}Cs^m	−80888	12	156.27	0.05		1.64	s	0.12	$11/2^-$	04			1972	IT=100	*
^{123}Cs^n	−80792	13	252	6		114	ns	5	$(9/2^+)$	04	GAu127	E	2000	IT=100	*
^{123}Cs^x	−81037	13	7	4		$R<0.1$			*spmix*						
^{123}Ba	−75655	12				2.7	m	0.4	$5/2^+$*	04			1962	β^+=100	*
^{123}Ba^m	−75534	12	120.95	0.08		830	ns	60	$1/2^+$#	04			1991	IT=100	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{123}La	−68650#	200#				17	s	3	11/2−#	04			1978	β^+=100	
^{123}Ce	−60290#	300#				3.8	s	0.2	(5/2)(+#)	04			1984	β^+=100;β^+p=?	
^{123}Pr	−50230#	400#				800#	ms		3/2+#					β^+ ?;β^+p ?	
*^{123}Pd	T : from15Lo04=108(1); others 06Mo07=174(+38-34) 14SmZZ=170(+49-52)														**
*^{123}Ag	J : 00Kr18=(7/2), $g_{9/2}$; hfs comparison to ^{107,107m}Ag														**
*^{123}Ag	D : %β^-n average 06Mo07=1.0(0.5) 93Ru01=0.55(0.05) 14TeZY=0.60(0.25);														**
*^{123}Ag	D : probably includes gs and isomer														**
*^{123}Ag	T : average 06Mo07=272(24) 95Fe12=293(7) 86Ma42=300(20) 83Re05=300(10);														**
*^{123}Ag	T : others 89Hu10=350(40) 76Lu02=390(30) 14TeZY=396(15)														**
*^{123}Ag^m	J : 00Kr18=(1/2), $p_{1/2}$; hfs comparison to ^{107,107m}Ag														**
*^{123}Ag^n	E : 13La11=1365+x keV above ^{123}Ag^m; x=50# keV estimated by Nubase														**
*^{123}Ag^p	T : average 13La11=393(16) 09St28=396(37); other 05WaZY=330(20)														**
*^{123}In^n	E : from a least-squares fit to gamma-ray energies in 04Sc42														**
*^{123}In^p	E : from 2078.1+x keV; x=50# keV estimated by Nubase														**
*^{123}Sn^n	E : from a least-squares fit to the level scheme in 16Is03														**
*^{123}Sn^p	E : from a least-squares fit to the level scheme in 16Is03														**
*^{123}Sn^q	E : from a least-squares fit to the level scheme in 16Is03														**
*^{123}Sb^m	E : from a least-squares fit to gamma-ray energies in 09Wa02														**
*^{123}Sb^n	E : from a least-squares fit to gamma-ray energies in 09Wa02														**
*^{123}Xe	J : 90NeZY=1/2														**
*^{123}Cs^m	J : E3 to 5/2+ followed by E2 to 1/2+														**
*^{123}Cs^n	E : from 231.63 + x; x<40 keV estimated by Nubase														**
*^{123}Ba	J : also 88We14=5/2														**
^{124}Ru	−33590#	600#				15	ms	3	0+	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{124}Rh	−44710#	400#				30	ms	2	2+#	15	20Sh.A	D	2010	β^-=100;β^-n<31;β^-2n ?	
^{124}Pd	−58400#	300#				88	ms	15	0+	14	14SmZZ	TD	1997	β^-=100;β^-n=17 5	*
^{124}Pd^m	−57400#	850#	1000#	800#		> 20	μs			14	12Ka36	ET	2012	IT≈100	
^{124}Ag	−66230	250			*	177.9	ms	2.6	(2−)	15	14Ba18	J	1984	β^-=100;β^-n=1.3 9	*
^{124}Ag^m	−66180#	260#	50#	50#	*	144	ms	20	9−#	15	14Ba18	TDJ	1995	β^-=100;β^-n ?	*
^{124}Ag^n	−66070	250	155.6	0.5		140	ns	50	(1+)	15	13La11	TJ	2012	IT=100	
^{124}Ag^p	−66000	250	231.1	0.7		1.48	μs	0.15	(1−)	15	13La11	TJ	2012	IT=100	*
^{124}Cd	−76699.4	2.6				1.25	s	0.02	0+	08			1974	β^-=100	
^{124}In	−80870	30			*	3.12	s	0.09	3+*	08			1964	β^-=100	
^{124}In^m	−80890	50	−20	60	BD*	3.67	s	0.03	8−*	08	14Le20	T	1974	β^-≈100;IT ?	*
^{124}Sn	−88231.5	1.3				STABLE		>100Py	0+	08	52Ka41	T	1922	IS=5.79 5;2β^- ?	
^{124}Sn^m	−86026.9	1.3	2204.620	0.023		270	ns	60	5−	08	FGK127	J	1979	IT=100	*
^{124}Sn^n	−85906.5	1.3	2324.96	0.04		3.1	μs	0.5	7−	08	14Is04	EJ	1979	IT=100	*
^{124}Sn^p	−85574.9	1.3	2656.6	0.3		51	μs	3	10+	08	14Is04	EJ	1992	IT=100	*
^{124}Sn^q	−83679.1	1.3	4552.4	0.3		260	ns	25	15−		14Is04	EJ	2012	IT=100	*
^{124}Sb	−87619.1	1.4				60.20	d	0.03	3−*	08			1939	β^-=100	
^{124}Sb^m	−87608.2	1.4	10.8627	0.0008		93	s	5	5+	08			1947	IT=75 5;β^-=25 5	
^{124}Sb^n	−87582.3	1.4	36.8440	0.0014		20.2	m	0.2	(8)−	08			1947	IT=100[gs=0,m=100]	
^{124}Sb^p	−87578.3	1.4	40.8038	0.0007		3.2	μs	0.3	(3+)	08	FGK208	J	1989	IT=100	*
^{124}Te	−90524.1	1.4				STABLE			0+	08			1932	IS=4.74 14	
^{124}I	−87364.6	2.3				4.1760	d	0.0003	2−*	08	92Wo03	T	1938	β^+=100	*
^{124}Xe	−87667.4	1.4				STABLE		>200Ty	0+	08	89Ba22	T	1922	IS=0.095 5;2β^+ ?	*
^{124}Cs	−81741	9				30.9	s	0.4	1+*	08			1969	β^+=100	
^{124}Cs^m	−81278	9	462.63	0.14		6.41	s	0.07	(7)+	08	17Ra20	D	1983	IT=99.89 2;β^+=0.11 2	*
^{124}Cs^x	−81711	22	30	20		$R=?$			*spmix*						
^{124}Ba	−79090	12				11.0	m	0.5	0+	08			1967	β^+=100	
^{124}La	−70260	60			*&	29.21	s	0.17	(7,8−)	08	92Id01	J	1978	β^+=100	
^{124}La^m	−70160#	120#	100#	100#	*&	21	s	4	2−#	08			1992	β^+=100	
^{124}Ce	−64920#	300#				9.1	s	1.2	0+	08	97As05	T	1978	β^+=100	*
^{124}Pr	−53150#	400#				1.2	s	0.2		08			1986	β^+=100;β^+p=?	
^{124}Nd	−44830#	500#				500#	ms		0+					β^+ ?;β^+p ?	
*^{124}Pd	T : from 15Lo04; others 06Mo07=38(+38-19) 14SmZZ=0.144(+25-24)														**
*^{124}Ag	T : average 15Lo04=180(3) 95Fe12=172(5);others 14Ba18=191(28) 84Hi03=170(30)														**
*^{124}Ag	D : %β^-n from 06Mo07, probably includes gs and isomer														**
*^{124}Ag^m	J : β^- feeding to 8+ and 10+ levels in ^{124}Cd in 14Ba18 would be														**
*^{124}Ag^m	J : consistent with J=9; 14Ba18 assumes J=(8-)														**
*^{124}Ag^p	E : 12Ka36=75.5(0.5) and 155.6(0.5) gamma rays in a cascade to gs														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{124}Ag^p T : average 13La11=1.46(0.20) 12Ka36=1.62(+0.29-0.24) 05WaZY=1.3(0.3) **
*^{124}In^m T : from 14Le20; others 86Go10=3.7(0.2) 74Fo23=2.4(0.3) **
*^{124}Sn^m J : E1 to 4+; L(p,p)=5 for ^{124}Sn^m **
*^{124}Sn^n T : from 17Ki09=2.83(0.12); other 79Fo10=3.1(0.5) **
*^{124}Sn^p T : average 17Ki09=55.0(+4.7-4.1) 92Br06=45(5) **
*^{124}Sn^q T : average 14Is04=260(30) 12As05=260(25) **
*^{124}Sb^p J : E2 to 5+ **
*^{124}I T : other (similar precision) 16Lu16=4.1758(14) 21Pi01=1.179(0.006) **
*^{124}Xe T : 2nu-$\varepsilon\varepsilon$ 16Ab03(XMASS)>4.7 Zy (at 90% C.L.); 17Ap02(XENON)>0.65 Zy; **
*^{124}Xe T : 2nu-ε(K)ε(K) 19Ap03=18(5,stat)(1,syst) Zy **
*^{124}Cs^m T : from 14Le20; other 83We07=6.3(0.2) **
*^{124}Ce T : average 97As05=10.8(1.5) 78Bo32=6(2) **

^{125}Ru	−28370#	300#				12#	ms	>550ns	$3/2^+$#		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{125}Rh	−41830#	500#				26.5	ms	2.0	$7/2^+$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{125}Pd	−53960#	400#				60	ms	6	$3/2^+$#	15	14SmZZ	TD	2008	β^-=100;β^-n=12 4	*
^{125}Pd^m	−53860#	400#	100#	50#		50#	ms		$11/2^-$#		19Ch24	ID	2019	$\beta^-\approx$100;IT ?	
^{125}Pd^n	−52160#	400#	1805.23	0.18		144	ns	4	$(23/2^+)$	15	19Wa14	ETJ	2019	IT=100	
^{125}Ag	−64520	430				160	ms	5	$(9/2^+)$*	15	14SmZZ	TD	1994	β^-=100;β^-n=11.8 10	*
^{125}Ag^m	−64420	430	97.1	0.5		50#	ms		$(1/2^-)$*		19Ch24	E	2019	β^- ?;IT ?;β^-n ?	*
^{125}Ag^n	−63020	430	1501.2	0.6		491	ns	20	$(17/2^-)$	15			2009	IT=100	
^{125}Cd	−73348.1	2.9				680	ms	40	$3/2^+$*	11	13Yo02	J	1986	β^-=100	
^{125}Cd^m	−73162	3	186	4	MD	480	ms	30	$11/2^-$*	11	13Yo02	J	1986	β^-=100	
^{125}Cd^n	−71700	5	1648	4		19	μs	3	$(19/2^+)$		11Si32	EJT	2011	IT=100	*
^{125}In	−80412.3	1.8				2.36	s	0.04	$9/2^+$*	11			1967	β^-=100	
^{125}In^m	−80060	12	352	12		12.2	s	0.2	$1/2^-$*	11			1974	β^-=100	
^{125}In^n	−78402.9	1.9	2009.4	0.7		9.4	μs	0.6	$(19/2^+)$	11			1998	IT=100	
^{125}In^p	−78251.1	2.0	2161.2	0.9		5.0	ms	1.5	$(23/2^-)$	11			1998	IT=100	
^{125}Sn	−85893.7	1.3				9.634	d	0.015	$11/2^-$*	11	20Yo.A	J	1939	β^-=100	*
^{125}Sn^m	−85866.2	1.3	27.50	0.14		9.77	m	0.25	$3/2^+$*	11	20Yo.A	J	1939	β^-=100	*
^{125}Sn^n	−84000.9	1.3	1892.8	0.3		6.2	μs	0.2	$19/2^+$	11	08Lo07	J	2000	IT=100	
^{125}Sn^p	−83834.2	1.4	2059.5	0.4		650	ns	60	$23/2^+$	11	16Is03	T	2008	IT=100	*
^{125}Sn^q	−83270.2	1.4	2623.5	0.5		230	ns	17	$27/2^-$	11	08Lo07	T	2000	IT=100	*
^{125}Sb	−88255.1	2.5				2.7576	y	0.0011	$7/2^+$*	11	FGK209	T	1951	β^-=100	*
^{125}Sb^m	−86283.9	2.5	1971.25	0.20		4.1	μs	0.2	$15/2^-$	11			2007	IT=100	
^{125}Sb^n	−86143.0	2.5	2112.1	0.3		28.5	μs	0.5	$19/2^-$	11	FGK128	J	2007	IT=100	*
^{125}Sb^q	−85784.1	2.5	2471.0	0.4		277.0	ns	6.4	$(23/2)^+$	11	19Bi04	T	2007	IT=100	*
^{125}Te	−89021.8	1.4				STABLE			$1/2^+$*	11			1931	IS=7.07 15	
^{125}Te^m	−88877.0	1.4	144.775	0.008		57.40	d	0.15	$11/2^-$	11			1949	IT=100	
^{125}I	−88836.0	1.4				59.392	d	0.008	$5/2^+$*	11	FGK209	T	1947	ε=100	
^{125}Xe	−87199.4	1.4				16.87	h	0.08	$1/2^+$*	11	19Sz01	T	1950	β^+=100	
^{125}Xe^m	−86946.8	1.4	252.61	0.14		56.9	s	0.9	$9/2^-$*	11			1954	IT=100	
^{125}Xe^n	−86903.5	1.4	295.89	0.15		140	ns	30	$7/2^+$	11			1979	IT=100	
^{125}Cs	−84090	8				44.35	m	0.29	$1/2^+$*	11	19Sz01	T	1954	β^+=100	
^{125}Cs^m	−83824	8	266.1	1.1		900	μs	30	$(11/2^-)$	11	98Su16	J	1998	IT=100	
^{125}Ba	−79669	11				3.3	m	0.3	$1/2^+$*	11			1968	β^+=100	
^{125}Ba^m	−79549#	23#	120#	20#		2.76	μs	0.14	$(7/2^-)$	11	FGK128	J	1989	IT=100	*
^{125}La	−73759	26			&	64.8	s	1.2	$11/2^-$#	11			1973	β^+=100	
^{125}La^m	−73652	26	107.00	0.10	&	390	ms	40	$(3/2^+)$	11	99Ca21	J	1998	IT=100	
^{125}Ce	−66660#	200#				9.7	s	0.3	$(7/2^-)$	11	02Pe15	J	1978	β^+=100;β^+p=?	
^{125}Ce^m	−66570#	200#	93.6	0.4		13	s	10	$(1/2^+)$	11	07Su07	ETJ	2007	IT=100	*
^{125}Pr	−58070#	300#				3.3	s	0.7	$3/2^+$#	11			2002	β^+=100;β^+p ?	
^{125}Nd	−48070#	400#				650	ms	150	$(5/2)(^+$#$)$	11			1999	β^+=100;β^+p>0	

*^{125}Pd T : average 15Lo04=57(10) 14SmZZ=61(+8-7) **
*^{125}Ag J : 00Kr18=(9/2) $g_{9/2}$; hfs comparison to ^{107,107m}Ag **
*^{125}Ag T : average 15Lo04=150(8) 14SmZZ=163(+11-9) 95Fe12=166(7) **
*^{125}Ag^m J : 00Kr18=(1/2) $p_{1/2}$; hfs comparison to ^{107,107m}Ag **
*^{125}Cd^n E : 11Si32=1461.8(0.7) keV above ^{125}Cd^m **
*^{125}Sn T : average 20Gu04=9.63(0.02) 68Er03=9.67(0.04) 66La13=9.625(0.025) **
*^{125}Sn^m T : unweighted average 20Gu04=10.01(0.08) 68Er03=9.52(0.05); **
*^{125}Sn^m T : Birge ratio=5.19 **
*^{125}Sn^p J : E2 to 19/2+ **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

(Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{125}Sn^q	J : E2 to 23/2-													**
*^{125}Sn^q	T : average 08Lo07=230(20) 00Zh47=230(30)													**
*^{125}Sb	T : evaluated by FGK209=1007.2(0.4) d using the world data; other													**
*^{125}Sb	T : Ensdf2011=2.75856(0.00025) based on old data, but the small													**
*^{125}Sb	T : uncertainty is not justified													**
*^{125}Sb^n	J : E2 to 15/2-													**
*^{125}Sb^n	T : average 19Bi04=28.8(0.6) 07Ju06=28.0(0.7)													**
*^{125}Sb^q	T : average 19Bi04=278(7) 07Ju06=272(16)													**
*^{125}Ba^m	E : 67.7(0.4) keV above 5/2+ level, estimated at 50#(20#) keV by Nubase													**
*^{125}Ce^m	T : symmetrized from 07Su07=134(+641-61) s for a fully ionized ion and													**
*^{125}Ce^m	T : α_T=38.1 for a 93.6(0.4) keV, E3 transition;													**
*^{125}Ce^m	T : Ensdf2011=3.4(2.7) s													**
^{126}Rh	−37200#	500#				19 ms	3	1$^-$#	15			2010	β^-=100;β^-n ?;β^-2n ?	
^{126}Pd	−51790#	400#				48.6 ms	0.8	0$^+$	15	14SmZZ	D	2008	β^-=100;β^-n=22 9	*
^{126}Pd^m	−49770#	400#	2023.5	0.7		330 ns	40	(5$^-$)	15	13Wa24	ETJ	2013	IT=100	
^{126}Pd^n	−49680#	400#	2109.7	0.9		440 ns	30	(7$^-$)	15	13Wa24	ETJ	2013	IT=100	
^{126}Pd^p	−49380#	400#	2406.0	1.0		23.0 ms	0.8	(10$^+$)	15	13Wa24	ETJ	2014	B=72 8;IT=28 8	
^{126}Ag	−60720#	200#				52 ms	10	3$^+$#	15	14Ba18	TD	1994	β^-=100;β^-n=13.7 11	*
^{126}Ag^m	−60620#	220#	100#	100#		108.4 ms	2.4	9$^-$#	15	14Ba18	TD	1995	β^-=100;IT ?;β^-n ?	*
^{126}Ag^n	−60470#	200#	254.8	0.5		27 μs	6	1$^-$#	15	13La11	JTD	2012	IT=100	
^{126}Cd	−72255.7	2.3				512 ms	5	0$^+$	03	18Ha30	T	1978	β^-=100	*
^{126}In	−77809	4				1.53 s	0.01	3$^+$*	03			1974	β^-=100	
^{126}In^m	−77719	5	90	7	MD	1.64 s	0.05	8$^-$*	03			1970	β^-=100	
^{126}In^n	−77566	4	243.3	0.2		22 μs	2	1$^-$		04Sc42	ETJ	2003	IT=100	
^{126}Sn	−86015	11				230 ky	14	0$^+$	03			1962	β^-=100	
^{126}Sn^m	−83796	11	2218.99	0.08		6.1 μs	0.7	7$^-$	03	12As05	T	1979	IT=100	*
^{126}Sn^n	−83451	11	2564.5	0.5		7.6 μs	0.3	10$^+$	03	12As05	TJ	2000	IT=100	*
^{126}Sn^p	−81668	11	4347.4	0.4		114 ns	2	15$^-$		14Is04	EJT	2012	IT=100	*
^{126}Sb	−86390	30				12.35 d	0.06	8$^-$	03	76Sm01	J	1956	β^-=100	
^{126}Sb^m	−86370	30	17.7	0.3		19.15 m	0.08	5$^+$	03	76Sm01	JD	1956	β^-=86 4;IT=14 4	
^{126}Sb^n	−86350	30	40.4	0.3		∼ 11 s		3$^-$	03	76Sm01	JD	1976	IT=100[gs=0,m=100]	
^{126}Sb^p	−86290	30	104.6	0.3		553 ns	5	3$^+$	03	76Sm01	JD	1976	IT=100	
^{126}Sb^q	−84580	30	1810.7	1.7		90 ns	16	(13$^+$)		19Bi04	EJT	2019	IT=100	
^{126}Te	−90064.2	1.4				STABLE		0$^+$	03			1924	IS=8.84 25	
^{126}I	−87910	4				12.93 d	0.05	2$^-$*	03			1938	β^+=52.7 5;β^-=47.3 5	
^{126}I^m	−87799	4	111.00	0.23		128 ns		3$^+$		12Mo.A	EJT	2012	IT=100	
^{126}Xe	−89146.387	0.006				STABLE		0$^+$	03			1922	IS=0.089 3;2β^+ ?	*
^{126}Cs	−84351	10				1.64 m	0.02	1$^+$*	03			1954	β^+=100	
^{126}Cs^m	−84078	10	273.0	0.7		∼ 1 μs		(4$^-$)	03	91TaZX	TD	1993	IT=100	*
^{126}Cs^n	−83755	10	596.1	1.1		171 μs	14	8$^-$#	03	07Wa09	J	1993	IT=100	*
^{126}Ba	−82670	12				100 m	2	0$^+$	03			1954	β^+=100	
^{126}La	−74970	90			*	54 s	2	5$^-$#	03			1961	β^+=100	
^{126}La^m	−74760	400	210	410	BD*	20 s	20	1$^-$#	03			1997	β^+=100	*
^{126}Ce	−70821	28				51.0 s	0.3	0$^+$	03			1978	β^+=100	
^{126}Pr	−60320#	200#				3.12 s	0.18	(4,5)	03	88Ba42	T	1983	β^+=100;β^+p=?	*
^{126}Nd	−53380#	300#				1# s	>200ns	0$^+$	03	00So11	I	2000	β^+ ?;β^+p ?	
^{126}Pm	−39750#	500#				500# ms							β^+ ?;β^+p ?	
*^{126}Pd	T : from 15Lo04,14Wa26=48.6(0.8); other 14SmZZ=56(+11-9)													**
*^{126}Ag	D : %β^-n from 14SmZZ, probably includes gs and isomer													**
*^{126}Ag^m	T : average 14Ba18=92(9) 15Lo04=98(5) 14SmZZ=114(3) 95Fe12=107(12)													**
*^{126}Cd	T : average 18Ha30=515(17) 15Lo04=513(6) 78Ga18=506(15);other 86Go10=600(30)													**
*^{126}Sn^m	T : average 12As05=6.6(1.4) 10Il01=5.9(0.8)													**
*^{126}Sn^n	T : average 12As05=7.7(0.5) 10Il01=7.5(0.3)													**
*^{126}Sn^p	T : other 12As05=160(20) not used (at variance)													**
*^{126}Xe	T : 2nu-$\varepsilon\varepsilon$ 16Ab03>4.7Zy (90% CL); 2nu-ε(K)ε(K) 19Ab04>19 Zy													**
*^{126}Cs^m	T : 91TaZX≤1 us; 218-keV and 241-keV gamma-ray transition below													**
*^{126}Cs^m	T : the (4-) isomer show the same lifetime, 166(15) us and 176(15) us,													**
*^{126}Cs^m	T : respectively, which is identical to ^{126}Cs^n													**
*^{126}Cs^n	D : 112-keV and 223-keV gamma rays to 5- and 6- members of K=4- band in													**
*^{126}Cs^n	D : 93Ko25 and 91TaZX													**
*^{126}La^m	T : 97As05: “by far shorter than 50 s”													**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{126}Pr T : average 95Os03=3.14(0.22) 88Ba42=3.0(0.4) 83Ni05=3.2(0.6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{127}Rh	−33730#	600#				28	ms	14	7/2$^+$#	15	15Lo04	TD	2015	β^-=100;β^-n ?;β^-2n ?	*
^{127}Pd	−47220#	500#				38	ms	2	11/2$^-$#	15	14SmZZ	TD	2010	β^-=100;β^-n<19;β^-2n ?	*
^{127}Pd^m	−45500#	500#	1717.91	0.23		39	μs	6	(19/2$^+$)	15	19Wa14	ETJ	2019	IT=100	
^{127}Ag	−58650#	200#			*	89	ms	2	(9/2$^+$)*	11	14SmZZ	D	1995	β^-=100;β^-n=14.6 15	*
^{127}Ag^m	−58630#	200#	20#	20#	*	20#	ms		(1/2$^-$)*		00Kr18	J		β^- ?;IT ?	
^{127}Ag^n	−56710#	200#	1938	17		67.5	ms	0.9	(27/2$^+$)		21Wa.A	DJT	2021	β^-=91.2 8;IT=8.8 8	*
^{127}Cd	−68741	6				480	ms	100	3/2$^+$*	11	13Yo02	J	1986	β^-=100;β^-n ?	*
^{127}Cd^m	−68456	4	285	8	MD	360	ms	40	11/2$^-$*		13Yo02	J	2019	β^-=100	*
^{127}Cd^n	−66896	10	1845	8		17.5	μs	0.3	(19/2$^+$)		10Na17	ETJ	2010	IT=100	*
^{127}In	−76880	10				1.086	s	0.007	9/2$^+$*	11	93Ru01	TD	1975	β^-=100;β^-n<0.03	*
^{127}In^m	−76486	15	394	18		3.618	s	0.021	1/2$^-$#	11	93Ru01	TD	1974	β^-=100;β^-n=0.70 4	*
^{127}In^n	−75110	40	1770	40	MD	1.04	s	0.10	(21/2$^-$)	11	18Ba08	E	2004	β^-=100;β^-n ?	
^{127}In^p	−74515	10	2364.7	0.9		9	μs	2	(29/2$^+$)	11	04Sc42	ETJ	2004	IT=100	
^{127}Sn	−83470	9				2.10	h	0.04	11/2$^-$*	11	20Yo.A	J	1951	β^-=100	
^{127}Sn^m	−83465	9	5.07	0.06		4.13	m	0.03	3/2$^+$*	11	20Yo.A	J	1962	β^-=100	
^{127}Sn^n	−81643	9	1826.67	0.16		4.52	μs	0.15	19/2$^+$	11	08Lo07	J	2000	IT=100	
^{127}Sn^p	−81539	9	1930.97	0.17		1.26	μs	0.15	(23/2$^+$)	11			2004	IT=100	
^{127}Sn^q	−80918	9	2552.4	1.0		250	ns	30	(27/2$^-$)	11	08Lo07	J	2008	IT=100	
^{127}Sb	−86698	5				3.85	d	0.05	7/2$^+$	11			1939	β^-=100	
^{127}Sb^m	−84778	5	1920.19	0.21		11.7	μs	0.1	15/2$^-$	11	19Bi04	T	1974	IT=100	*
^{127}Sb^n	−84373	5	2324.7	0.4		269	ns	5	23/2$^+$	11	19Bi04	T	2005	IT=100	*
^{127}Te	−88280.5	1.4				9.35	h	0.07	3/2$^+$	11			1938	β^-=100	
^{127}Te^m	−88192.3	1.4	88.23	0.07		106.1	d	0.7	11/2$^-$	11	17Ni03	D	1940	IT=97.86 3;β^-=2.14 3	
^{127}I	−88983	4				STABLE			5/2$^+$*	11			1920	IS=100	
^{127}Xe	−88321	4				36.342	d	0.003	1/2$^+$*	11	FGK209	T	1950	ε=100	*
^{127}Xe^m	−88024	4	297.10	0.08		69.2	s	0.9	9/2$^-$*	11	90NeZY	J	1940	IT=100	*
^{127}Cs	−86240	6				6.25	h	0.10	1/2$^+$*	11			1950	β^+=100	
^{127}Cs^m	−85788	6	452.23	0.21		55	μs	3	(11/2)$^-$	11			1980	IT=100	
^{127}Ba	−82818	11				12.7	m	0.4	1/2$^+$*	11			1952	β^+=100	
^{127}Ba^m	−82738	11	80.32	0.11		1.93	s	0.07	7/2$^-$	11			1992	IT=100	
^{127}La	−77896	26				5.1	m	0.1	(11/2$^-$)	11			1963	β^+=100	
^{127}La^m	−77882	26	14.2	0.4		3.7	m	0.4	(3/2$^+$)	11			1963	β^+≈100	
^{127}Ce	−71979	29				34	s	2	(1/2$^+$)	11			1978	β^+=100	
^{127}Ce^m	−71972	29	7.3	1.1		28.6	s	0.7	(5/2$^+$)	11			1978	β^+=100	
^{127}Ce^n	−71942	29	36.9	1.1		> 10	μs		(7/2$^-$)	11			1995	IT=100	*
^{127}Pr	−64540#	200#				4.2	s	0.3	3/2$^+$#	11			1995	β^+=100	
^{127}Pr^m	−63940#	280#	600#	200#		2#	μs		(11/2$^-$)	11	98Mo30	J	1998	IT ?	
^{127}Nd	−55910#	300#				1.8	s	0.4	5/2$^+$#	11			1983	β^+=100;β^+p=?	
^{127}Pm	−45310#	400#				1#	s		3/2$^+$#					β^+ ?;p ?	

*^{127}Rh T : symmetrized from 15Lo04=20(+20-7) **
*^{127}Pd T : from 15Lo04; other 14SmZZ=73(+24-23) **
*^{127}Ag T : from 15Lo04; other 96Wo.A=79(3), supersedes 95Fe12=109(25), same group **
*^{127}Ag J : 00Kr18=(9/2) $g_{9/2}$; hfs comparison to ^{107,107m}Ag **
*^{127}Ag^m J : 00Kr18=(1/2) $p_{1/2}$; hfs comparison to ^{107,107m}Ag **
*^{127}Ag^n E : from 21Wa.A=150(+14-20) keV above the 1792.2(0.9) keV **
*^{127}Cd T : symmetrized 19Lo04=450(+120–80); other 15Lo04=330(20) mixed states **
*^{127}Cd^m T : from 19Lo04 **
*^{127}Cd^n E : 1560.1(0.5) keV above ^{127}Cd^m **
*^{127}Cd^n T : others 21Wa.A=18(1) 12Ka36=11.0(+9.2-3.5) **
*^{127}In T : average 93Ru01=1.083(0.007) 86Go10=1.22(0.05) 83Sh07=0.99(0.10) **
*^{127}In T : 81En05=1.10(0.04); others 80Lu04=1.12(0.02), superseded by 93Ru01, **
*^{127}In T : 02Pf04=1.090(0.010), compilation **
*^{127}In^m T : average 93Ru01=3.580(0.025) 86ReZU=3.70(0.04) 83Sh07=3.76(0.31) **
*^{127}In^m T : 80De35=3.7(0.1); other 02Pf04=3.67(4), compilation **
*^{127}In^m D : %β^-n average 93Ru01=0.72(0.04) 86ReZU=0.54(0.11) **
*^{127}Sb^m T: other 74Ap01=11(1) **
*^{127}Sb^n T : others 09Wa24=234(12) 05Po03=165(20) outlier, not used **
*^{127}Xe J : 90NeZY=1/2 **
*^{127}Xe^m J : 90NeZY=9/2 **
*^{127}Ce^n E : 95Os03=29.56(0.05) keV above ^{127}Ce^m **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{127}Pr^m T : estimated by FGK208 from BE3(11/2- to 5/2+)=41.2(2.0) [W.u.] in **
*^{127}Pr^m T : ^{131}Pr **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{128}Rh	−27340#	300#				8#	ms	>550ns			18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{128}Pd	−44390#	500#				35	ms	3	0^+	16	15Lo04	T	2010	β^-=100;β^-n ?	*
^{128}Pd^m	−42240#	500#	2151.0	1.0		5.8	μs	0.8	(8^+)	16			2013	IT=100	
^{128}Ag	−54710#	300#				60	ms	3	3^+#	15	14SmZZ	TD	2000	β^-=100;β^-n=20 5;β^-2n ?	*
^{128}Cd	−67238	6				246	ms	2	0^+	15	16Du13	T	1986	β^-=100;β^-n ?	*
^{128}Cd^m	−65368	6	1870.5	0.3		270	ns	7	(5^-)	15			2009	IT=100	
^{128}Cd^n	−64523	6	2714.6	0.4		3.56	μs	0.06	(10^+)	15			2009	IT=100	
^{128}Cd^p	−62951	6	4286.6	1.5		6.3	ms	0.8	(15^-)		17Ju02	ETJ	2016	IT=100	
^{128}In	−74190.1	1.3				816	ms	27	$(3)^+$	15	93Ru01	D	1975	β^-=100;β^-n=0.038 3	*
^{128}In^m	−73942.2	1.3	247.87	0.10		23	μs	2	$(1)^-$	15	04Sc42	J	1988	IT=100	
^{128}In^n	−73905.0	2.0	285.1	2.2	MD	720	ms	100	(8^-)	15	20Ne06	E	1986	β^-=100;IT ?;β^-n ?	
^{128}In^p	−72392.5	1.4	1797.6	1.6	MD	> 0.3	s		(16^+)		20Ne06	EJT	2020	$\beta^-\approx$100;IT ?;β^-n ?	
^{128}Sn	−83361	18				59.07	m	0.14	0^+	15			1956	β^-=100	
^{128}Sn^m	−81270	18	2091.50	0.11		6.5	s	0.5	7^-	15			1979	IT=100	*
^{128}Sn^n	−80869	18	2491.91	0.17		2.91	μs	0.14	10^+	15			1981	IT=100	*
^{128}Sn^p	−79262	18	4099.5	0.4		220	ns	30	(15^-)	15			2011	IT=100	
^{128}Sb	−84630	19			*	9.05	h	0.04	8^-*	15			1956	β^-=100	
^{128}Sb^m	−84620	18	10	6	*	10.41	m	0.18	5^+	15			1955	β^-=96.4 10;IT=3.6 10	*
^{128}Sb^n	−83013	19	1617.3	0.7		500	ns	20	(11^+)		19Bi04	ETJ	2019	IT=100	
^{128}Sb^p	−82860	19	1769.9	1.2		217	ns	7	(13^+)		19Bi04	ETJ	2019	IT=100	
^{128}Te	−88993.8	0.7				2.25	Yy	0.09	0^+	15	20Ba.A	T	1924	IS=31.74 8;2β^-=100	
^{128}Te^m	−86203.0	0.8	2790.8	0.3		363	ns	27	(10^+)	15	04Va03	T	1998	IT=100	*
^{128}I	−87738	4				24.99	m	0.02	1^+*	15			1934	β^-=93.1 8;β^+=6.9 8	
^{128}I^m	−87600	4	137.851	0.003		845	ns	20	4^-	15			1982	IT=100	
^{128}I^n	−87571	4	167.368	0.004		175	ns	15	$(6)^-$	15			1991	IT=100	
^{128}Xe	−89860.534	0.005				STABLE			0^+	15			1922	IS=1.910 13	
^{128}Xe^m	−87073.3	0.3	2787.2	0.3		83	ns	2	8^-	15			1981	IT=100	
^{128}Cs	−85932	5				3.640	m	0.014	1^+*	15	93Al03	T	1951	β^+=100	*
^{128}Ba	−85369.2	1.6				2.43	d	0.05	0^+	15			1950	ε=100	
^{128}La	−78630	50			*	5.18	m	0.14	(5^+)	15	97Ha30	T	1961	β^+=100	*
^{128}La^m	−78530#	110#	100#	100#	*	< 1.4	m		$(1^+,2^-)$	15	97Ha30	T	1995	β^+=100;IT ?	
^{128}Ce	−75534	28				3.93	m	0.02	0^+	15	00Li08	T	1968	β^+=100	*
^{128}Pr	−66331	30				2.85	s	0.09	(3^+)	15	99Xi03	J	1985	β^+=100;β^+p=?	*
^{128}Nd	−60530#	200#				5#	s		0^+	15			1985	β^+ ?	*
^{128}Pm	−48220#	300#				1.0	s	0.3	4^+#	15	93Li40	D	1999	$\beta^+\approx$100;β^+p= ?;p=0	*
^{128}Sm	−39150#	500#				500#	ms		0^+					β^+ ?;β^+p ?	

*^{128}Pd T : other 14SmZZ<262 ms **
*^{128}Ag T : average 15Lo04=59(5) 14SmZZ=73(+10-9) 96Wo.A=58(5) 95Kr.A=60(10) **
*^{128}Cd T : average 16Du13=246.2(2.1) 15Lo04t=245(5) **
*^{128}In T : average 15Lo04=810(30) 86Go10=840(60) **
*^{128}In D : %β^-n from 93Ru01, probably includes gs and isomer **
*^{128}Sn^m J : E3 to 4+ **
*^{128}Sn^n J : E2 to 8+ **
*^{128}Sb^m E : less than 20 keV above the ground state; see Ensdf2015 for details **
*^{128}Te^m T : average 04Va03=337(59) 98Zh09=370(30) **
*^{128}Cs T : average 93Al03=3.66(0.02) 76He04=3.62(0.02) **
*^{128}La T : average 97Ha30=5.4(0.2) 77Zo02=5.2(0.4) 66Pa06=4.9(0.4) 66Li04=4.9(0.4) **
*^{128}Ce T : average 00Li08=4.0(0.1) 97Ha30=4.1(0.3) 97As05=3.925(0.021) **
*^{128}Pr T : average 99Xi03=2.8(0.1) 88Ba42=3.1(0.3) 85Wi07=3.2(+0.5-0.4) **
*^{128}Pr D : β^+p observed in 85Wi07, but was not quantified **
*^{128}Nd T : 83Ni05=4(2)s, but 85Wi07 associated it with decay of ^{128}Pr **
*^{128}Pm D : %p 93Li40=0 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{129}Pd	−37880#	600#				31	ms	7	$7/2^-$#	15			2015	β^-=100;β^-n ?;β^-2n ?	
^{129}Ag	−51870#	400#			*	49.9	ms	3.5	$9/2^+$#	14	14SmZZ	D	2000	β^-=100;β^-n<20	*
^{129}Ag^m	−51850#	400#	20#	20#	*	10#	ms		$1/2^-$#	14				β^- ?;β^-n ?	*
^{129}Cd	−63122	5				147	ms	3	$11/2^-$*	14	16Du13	T	2003	β^-=100;β^-n=?	*
^{129}Cd^m	−62779	6	343	8	MD	157	ms	8	$3/2^+$*	14	20Ma09	E	1986	β^-=100;β^-n=?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{129}Cd^{n}	−60839	9	2283	8		3.6 ms 0.2	(21/2^{+})	14	14Ta29	TJE	2014	IT=100	*
^{129}In	−72834.9	2.0				570 ms 10	9/2^{+}	14	15Lo04	T	1975	β^-=100;β^-n=0.23 7	*
^{129}In^{m}	−72384.2	2.0	450.73	0.16		1.23 s 0.03	1/2^{-}	14	04Ga24	J	1976	$\beta^-\approx$100;IT ?;β^-n=3.6 4	*
^{129}In^{n}	−71146.9	2.0	1687.97	0.25		11.2 μs 0.2	(17/2^{-})	14	14Ta.A	T	2003	IT=100	
^{129}In^{p}	−71180	50	1650	50	BD	670 ms 100	(23/2^{-})	14	04Ga24	ETJ	2004	$\beta^-\approx$100;IT ?	
^{129}In^{q}	−70890	50	1941	50		110 ms 15	(29/2^{+})	14			2004	IT$\approx$100;β^- ?	*
^{129}Sn	−80591	17				2.23 m 0.04	3/2^{+}*	14	20Yo.A	J	1962	β^-=100	
^{129}Sn^{m}	−80556	17	35.15	0.05		6.9 m 0.1	11/2^{-}*	14	20Yo.A	J	1962	β^-=100	
^{129}Sn^{n}	−78829	17	1761.6	1.0		3.49 μs 0.11	(19/2^{+})	14	08Lo07	T	2000	IT=100	*
^{129}Sn^{p}	−78788	17	1802.6	1.0		2.22 μs 0.13	23/2^{+}	14	08Lo07	TJ	2000	IT=100	*
^{129}Sn^{q}	−78038	17	2552.9	1.1		221 ns 18	(27/2^{-})	14	08Lo07	J	2008	IT=100	
^{129}Sb	−84629	21				4.366 h 0.026	7/2^{+}	14			1939	β^-=100	
^{129}Sb^{m}	−82778	21	1851.31	0.06		17.7 m 0.1	19/2^{-}	14	19Bi04	J	1982	β^-=85;IT=15	
^{129}Sb^{n}	−82768	21	1861.06	0.05		2.23 μs 0.17	15/2^{-}	14	19Bi04	TJ	1987	IT=100	*
^{129}Sb^{p}	−82490	21	2139.4	0.3		0.89 μs 0.03	23/2^{+}	14	19Bi04	TJ	2003	IT=100	
^{129}Te	−87004.9	0.7				69.6 m 0.3	3/2^{+}	14			1939	β^-=100	
^{129}Te^{m}	−86899.4	0.7	105.51	0.03		33.6 d 0.1	11/2^{-}	14			1940	IT=64 7;β^-=36 7	
^{129}I	−88507	3				16.14 My 0.12	7/2^{+}*	14	18Ga37	T	1951	β^-=100	
^{129}Xe	−88696.070	0.005				STABLE	1/2^{+}*	14			1920	IS=26.401 138	
^{129}Xe^{m}	−88459.93	0.03	236.14	0.03		8.88 d 0.02	11/2^{-}*	14	90NeZY	J	1951	IT=100	*
^{129}Cs	−87499	5				32.06 h 0.06	1/2^{+}*	14			1950	β^+=100	
^{129}Cs^{m}	−86924	5	575.40	0.14		718 ns 21	(11/2^{-})	14			1977	IT=100	
^{129}Ba	−85061	11				2.23 h 0.11	1/2^{+}	14			1950	β^+=100	
^{129}Ba^{m}	−85053	11	8.42	0.06		2.135 h 0.010	7/2^{+}	14			1950	$\beta^+\approx$100;IT=?	
^{129}La	−81324	21				11.6 m 0.2	(3/2^{+})	14			1963	β^+=100	
^{129}La^{m}	−81152	21	172.33	0.20		560 ms 50	(11/2^{-})	14			1969	IT=100	
^{129}Ce	−76288	28				3.5 m 0.3	(5/2^{+})	14			1977	β^+=100	
^{129}Pr	−69774	30				30 s 4	(3/2^{+})	14	96Gi08	J	1977	β^+=100	
^{129}Pr^{m}	−69390	30	382.57	0.24		26# μs 11#	(11/2^{-})	14	FGK208	T	1997	IT=100	*
^{129}Nd	−62380#	200#				6.8 s 0.6	7/2^{-}#	14	10Xu12	T	1977	β^+=100;β^+p=?	*
^{129}Nd^{m}	−62330#	220#	50#	100#		2.6 s 0.4	1/2^{+}#	14			2010	β^+=100;β^+p=?	
^{129}Pm	−53180#	300#				2.4 s 0.9	5/2^{+}#	14			2004	β^+=100;β^+p ?;p ?	
^{129}Sm	−42330#	500#				550 ms 100	(1/2^{+},3/2^{+})	14			1999	β^+=100;β^+p=?	

*^{129}Ag T : average 15Lo04=52(4) 00Kr18=46(+5-9) **
*^{129}Ag D : β^-n was observed by 00Kr18, but it was not quantified **
*^{129}Ag^{m} T : 00Kr18=158(60) ms is not convincing; not adopted in 02Pf04 (same group) **
*^{129}Cd T : from 16Du13=147(3) gated by gammas's in the high-spin decay; others **
*^{129}Cd T : 15Ta13=155(3) 09Ar04=104(6) **
*^{129}Cd D : β^-n was observed by 05Kr20, but it was not quantified **
*^{129}Cd J : 13Yo02=11/2 **
*^{129}Cd^{m} D : β^-n was observed by 05Kr20, but it was not quantified **
*^{129}Cd^{m} T : from 16Du13=157(8) gated by gammas's in the low-spin decay; others **
*^{129}Cd^{m} T : 15Ta13=146(8) 15Lo04=154.5(2.0), mixture of two states, 09Ar04=242(8) **
*^{129}Cd^{m} J : 13Yo02=3/2 **
*^{129}Cd^{n} E : 14Ta29=1940.0(1.4) keV above ^{129}Cd^{m} **
*^{129}In J : from 04Ga24 **
*^{129}In^{m} E : from a least-squares fit to the level scheme in 15Ta13; others **
*^{129}In^{m} E : 13Ka08=459(5) 18Ba08=444(15), direct mass measurements **
*^{129}In^{q} E : 281.0(0.2) keV gamma above ^{129}In^{p} **
*^{129}Sn^{n} T : average 08Lo07=3.4(0.4) 04Ga24=3.2(0.2) 00Pi03=3.7(0.2) **
*^{129}Sn^{n} T : 00Ge07=3.6(0.2) **
*^{129}Sn^{p} T : average 08Lo07=2.4(4) 04Ga24=2.0(2) 00Ge07=2.4(2) **
*^{129}Sb^{n} T : average 19Bi04=2.3(0.3) 03Ge04=2.2(0.2) **
*^{129}Xe^{m} J : 90NeZY=11/2 **
*^{129}Pr^{m} T : estimated by FGK208 from BE3(11/2- to 5/2+)=41.2(2.0) [W.u.] in **
*^{129}Pr^{m} T : ^{131}Pr using the known branching intensities and α_T **
*^{129}Nd T : average 10Xu12=6.7(0.7) 97Gi07=7(1); other 85Wi07=4.9(0.2) is **
*^{129}Nd T : for a mixture between the gs and the isomer **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{130}Pd	−32730#	300#				27# ms >550ns	0^{+}		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{130}Ag	−45900#	420#				40.6 ms 4.5	1^{-}#	15	15Lo04	T	2000	β^-=100;β^-n ?;β^-2n ?	*
^{130}Cd	−61118	22				126.8 ms 1.8	0^{+}	08	16Du13	T	1986	β^-=100;β^-n=3.5 10	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{130}Cd^m	−58988	22	2129.6	1.0		240 ns 16	(8$^+$)	08	12Ka36	ET	2007	IT=100	*
^{130}In	−69906.5	1.8			*	273 ms 5	1($^-$)	08	15Lo04	T	1973	β^-=100;β^-n=0.93 13	*
^{130}In^m	−69840.0	2.0	66.5	2.7	MD*	540 ms 10	(10$^-$)	08	20Ne06	E	1973	β^-=100;β^-n=1.80 7	*
^{130}In^n	−69521.1	2.1	385.4	2.6	MD	540 ms 10	(5$^+$)	08	20Ne06	E	1986	β^-=100;β^-n=1.80 7	*
^{130}In^p	−69518.2	1.8	388.3	0.2		4.6 μs 0.2	(3$^+$)	08	16Ju03	T	2003	IT=100	*
^{130}Sn	−80132.2	1.9				3.72 m 0.07	0$^+$	01			1972	β^-=100	
^{130}Sn^m	−78185.3	1.9	1946.88	0.10		1.7 m 0.1	7$^-$	01	05Le34	J	1974	β^-=100	
^{130}Sn^n	−77697.4	1.9	2434.79	0.12		1.501 μs 0.017	(10$^+$)	01	11Pi05	T	1981	IT=100	
^{130}Sb	−82286	14				39.5 m 0.8	8$^-$	01	02Ge07	J	1962	β^-=100	
^{130}Sb^m	−82281	14	4.80	0.20		6.3 m 0.2	4$^+$	01	94WaZU	J	1962	β^-=100	
^{130}Sb^n	−82201	14	84.67	0.04		800 ns 100	6$^-$	01	02Ge07	TJ	2002	IT=100	
^{130}Sb^p	−80778	14	1508	1		600 ns 15	(11$^+$)		19Bi04	ETJ	2019	IT=100	
^{130}Sb^q	−80741	14	1544.7	0.5		1.25 μs 0.01	(13$^+$)		02Ge07	ETJ	2002	IT=100	*
^{130}Te	−87352.960	0.011				791 Ey 21	0$^+$	01	20Ba.A	T	1924	IS=34.08 62;2β^-=100	
^{130}Te^m	−85206.55	0.04	2146.41	0.04		186 ns 11	7$^-$	01	04Va03	T	1972	IT=100	*
^{130}Te^n	−84685.8	0.8	2667.2	0.8		1.90 μs 0.08	(10$^+$)	01	04Br19	E	1998	IT=100	*
^{130}Te^p	−82979.1	0.9	4373.9	0.9		53 ns 8	(15$^-$)	01	14As01	JTE	1998	IT=100	*
^{130}I	−86936	3				12.36 h 0.01	5$^+$*	01			1938	β^-=100	
^{130}I^m	−86896	3	39.9525	0.0013		8.84 m 0.06	2$^+$	01			1966	IT=84 2;β^-=16 2	
^{130}I^n	−86866	3	69.5865	0.0007		133 ns 7	6$^-$	01			1989	IT=100	*
^{130}I^p	−86854	3	82.3960	0.0019		315 ns 15	(8$^-$)	01			1989	IT=100	
^{130}I^q	−86851	3	85.1099	0.0010		254 ns 4	6$^-$	01			1975	IT=100	*
^{130}Xe	−89880.474	0.009				STABLE	0$^+$	01			1922	IS=4.071 22	
^{130}Cs	−86900	8				29.21 m 0.04	1$^+$*	01			1952	β^+=98.4;β^-=1.6	
^{130}Cs^m	−86737	8	163.25	0.11		3.46 m 0.06	5$^-$*	01			1977	IT≈100;β^+=0.16 2	
^{130}Cs^x	−86873	17	27	15		$R=0.2$ 0.1	$fsmix$						
^{130}Ba	−87256.78	0.29				STABLE ∼1Zy	0$^+$	01	15Ba11	T	1936	IS=0.11 1;2β^+ ?	
^{130}Ba^m	−84781.7	0.3	2475.12	0.18		9.54 ms 0.14	8$^-$	01	02Mo31	T	1969	IT=100	*
^{130}La	−81627	26				8.7 m 0.1	3($^+$)	01			1961	β^+=100	
^{130}La^m	−81413	26	214.0	0.5		742 ns 28	(5$^+$)		14Io01	ETJ	2012	IT=100	*
^{130}Ce	−79423	28				22.9 m 0.5	0$^+$	01			1965	β^+=100	
^{130}Ce^m	−76969	28	2453.6	0.3		100 ns 8	7$^-$	01	99Io02	J	1999	IT=100	
^{130}Pr	−71180	60				40.0 s 0.4	(6,7)($^+$#)	01	88Ba42	J	1977	β^+=100	
^{130}Pr^m	−71080#	120#	100#	100#		10# s	2$^+$#	01	88Ba42	J	1988	β^+ ?	*
^{130}Nd	−66596	28				21 s 3	0$^+$	01	01Gi17	T	1977	β^+=100	*
^{130}Pm	−55470#	200#				2.6 s 0.2	(5$^+$,6$^+$,4$^+$)	01	99Xi03	J	1985	β^+=100;β^+p=?	
^{130}Sm	−47700#	400#				1# s	0$^+$	01			1999	β^+ ?	
^{130}Eu	−33510#	540#				1.0 ms 0.4	(1$^+$)	08			2004	p≈100;β^+ ?;β^+p ?	*

*^{130}Ag T : average 15Lo04=42(5) 05Kr20=35(10) **
*^{130}Cd T : average 16Du13=126(4) 15Lo04=127(2) **
*^{130}Cd^m T : average 12Ka36=248(+21-19) 07Ju05=220(30) **
*^{130}Cd^m E : 12Ka36=128.0(0.5), 138.0(0.5), 538.2(0.5) and 1325.4(0.5)-keV **
*^{130}Cd^m E : gamma rays in a cascade to gs **
*^{130}In T : average 15Lo04=284(10) 93Ru01=256(9) 86ReZU=278(7) **
*^{130}In D : %β^-n average 93Ru01=1.49(0.22) 86Wa17=0.90(0.05), Birge ratio=2.615; **
*^{130}In D : other 86ReZU=0.91(10), same as 86Wa17 **
*^{130}In^m D : %β^-n average 93Ru01=2.03(0.12) 86Wa17=1.67(0.09), includes both **
*^{130}In^m D : ^{130}In^m and ^{130}In^n isomers **
*^{130}In^m J : 81Fo02=(10-); direct β^- decay to 9- agrees with 8-,9- or 10- **
*^{130}In^n D : %β^-n average 93Ru01=2.03(0.12) 86Wa17=1.67(0.09), includes both **
*^{130}In^n D : ^{130}In^m and ^{130}In^n isomers **
*^{130}In^p T : average 16Ju03=4.4(0.2) 12Ka36=5.25(+0.40-0.35); other 04Sc42=3.1(0.3) **
*^{130}Sb^q T : from 19Bi04; other 02Ge07=1.8(0.2) **
*^{130}Te^m T : other 72Ke28=115(11) **
*^{130}Te^n T : other 98Zh09=4.2(0.9), conflicting data, not used **
*^{130}Te^p T : others 04Br19=45 98HoZP=261(33) **
*^{130}I^n J : E1 to 5+ **
*^{130}I^q J : E1 to 5+ **
*^{130}Ba^m T : others 66Br14=8.8(0.2) 69Wa.A=13.5(1.0) **
*^{130}La^m T : average 14Io01=760(90) 12Ta18=740(30) **
*^{130}Pr^m J : evidence for a low-spin component in ^{130}Pr activity in 88Ba42 **
*^{130}Nd T : others 00Xu08=13(3) 77Bo02=28(3) conflicting, not used **
*^{130}Eu T : symmetrized from 0.90(+0.49-0.29) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{131}Pd	−25740#	300#				20#	ms	>550ns	$7/2^-$#		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{131}Ag	−40750#	500#				35	ms	8	$9/2^+$#	15			2013	β^-=100;β^-n ?;β^-2n=10	
^{131}Cd	−55212	19				98	ms	2	$7/2^-$#	06	15Lo04	T	2000	β^-=100;β^-n=3.5 10;β^-2n ?	*
^{131}In	−68024.4	2.2				261.5	ms	2.8	$9/2^+$	06	19Du12	TDJ	1976	β^-=100;β^-n=2.25 21	*
^{131}In^m	−67648.4	2.5	376	3	MD	328	ms	15	$1/2^-$	06	19Or.A	E	1984	β^-=100;β^-n=2.25 21;IT ?	*
^{131}In^n	−64280	90	3750	90	BD	322	ms	41	$(21/2^+)$	06	19Du12	TD	1984	β^-=100;β^-n=12 7;IT ?	*
^{131}In^p	−64240.8	2.3	3783.6	0.5		669	ns	34	$(17/2^+)$		09Go40	TJ	2009	IT=100	*
^{131}Sn	−77265	4				56.0	s	0.5	$3/2^+$*	06	20Yo.A	J	1963	β^-=100	
^{131}Sn^m	−77200	4	65.1	0.3		58.4	s	0.5	$11/2^-$*	06	04Fo06	E	1977	β^-=100;IT ?	*
^{131}Sn^n	−72595	4	4670.0	0.4		316	ns	5	$(23/2^-)$	06	19Du12	T	2001	IT=100	*
^{131}Sb	−81981.4	2.1				23.03	m	0.04	$7/2^+$	06			1956	β^-=100	
^{131}Sb^m	−80305.3	2.1	1676.06	0.06		64.2	μs	2.6	$15/2^-$	06	19Bi04	T	1969	IT=100	*
^{131}Sb^n	−80294.2	2.3	1687.2	0.9		4.3	μs	0.8	$19/2^-$	06	00Ge18	TJ	2000	IT=100	
^{131}Sb^p	−79815.8	2.6	2165.6	1.5		0.97	μs	0.03	$23/2^+$	06	19Bi04	T	2000	IT=100	*
^{131}Te	−85211.02	0.06				25.0	m	0.1	$3/2^+$	06			1939	β^-=100	
^{131}Te^m	−85028.76	0.06	182.258	0.018		32.48	h	0.11	$11/2^-$	06	08Ea01	T	1940	β^-=74.1 5;IT=25.9 5	
^{131}Te^n	−83271.0	0.4	1940.0	0.4		93	ms	12	$(23/2^+)$	06			1998	IT=100	
^{131}I	−87442.7	0.6				8.0249	d	0.0006	$7/2^+$*	06	FGK209	T	1939	β^-=100	
^{131}I^m	−85524.3	0.7	1918.4	0.4		24	μs	1	$19/2^-$		09Wa11	EJT	2009	IT=100	
^{131}Xe	−88413.575	0.005				STABLE			$3/2^+$*	06			1920	IS=21.232 51	
^{131}Xe^m	−88249.645	0.009	163.930	0.008		11.948	d	0.012	$11/2^-$*	06	FGK209	T	1966	IT=100	*
^{131}Cs	−88055.57	0.18				9.689	d	0.016	$5/2^+$*	06			1947	ε=100	
^{131}Ba	−86679.0	0.4				11.52	d	0.01	$1/2^+$*	06	12Da04	T	1947	β^+=100	
^{131}Ba^m	−86491.0	0.4	187.995	0.009		14.26	m	0.09	$9/2^-$*	06	12Da04	T	1963	IT=100	
^{131}La	−83769	28				59	m	2	$3/2^+$*	06			1951	β^+=100	
^{131}La^m	−83464	28	304.60	0.24		170	μs	7	$11/2^-$	06			1966	IT=100	
^{131}Ce	−79710	30				10.3	m	0.3	$7/2^+$	06			1966	β^+=100	
^{131}Ce^m	−79650	30	63.09	0.09		5.4	m	0.4	$(1/2^+)$	06	96Gi08	E	1966	β^+=100	
^{131}Pr	−74300	50				1.50	m	0.03	$(3/2^+)$	06	96Gi08	TJ	1977	β^+=100	*
^{131}Pr^m	−74150	50	152.4	0.3		5.73	s	0.20	$(11/2^-)$	06			1996	IT=96.4 12;β^+=3.6 12	
^{131}Nd	−67768	28				25.4	s	0.9	$(5/2^+)$	06			1977	β^+=100;β^+p=?	
^{131}Pm	−59770#	200#				6.3	s	0.8	$(11/2^-)$	06	99Ga41	T	1998	β^+=100	
^{131}Sm	−50280#	400#				1.2	s	0.2	$5/2^+$#	06			1986	β^+=100;β^+p=?	
^{131}Eu	−39460#	400#				17.8	ms	1.9	$3/2^+$	06			1998	p=89 9;β^+ ?;β^+p ?	

*^{131}Cd T : 15Lo04=98.0(0.2) is a typo; other 00Ha55=68(3) **
*^{131}In D : %β^-n average 93Ru01=2.2(0.3) 19Du12 β^-n=2.3(0.3), value includes **
*^{131}In D : gs and ^{131}In^m **
*^{131}In T : average 19Du12=265(8) 15Lo04=261(3) **
*^{131}In J : from β^- decay properties in 04Fo06 and 19Du12 **
*^{131}In^m T : from 19Du12 **
*^{131}In^m J : from β^- decay properties in 04Fo06 and 19Du12 **
*^{131}In^m D : %β^-n average 93Ru01=2.2(0.3) 19Du12 β^-n=2.3(0.3), value includes **
*^{131}In^m D : gs and ^{131}In^m **
*^{131}In^n T : average 19Du12=323(55) 84Fo19=320(60) **
*^{131}In^p T : average 12Ka36=685(+42-39) 09Go40=630(60) **
*^{131}Sn^m J : 20Yo.A=11/2 **
*^{131}Sn^n E : 4605.02(0.21) keV above ^{131}Sn^m **
*^{131}Sn^n T : others 12Ka36=309(+24-23) 84Fo19=300(20) **
*^{131}Sb^m T : average 19Bi04=64(3) 00Ge18=65(5) **
*^{131}Sb^p J : from 00Ge18 **
*^{131}Xe^m J : 90NeZY=11/2 **
*^{131}Pr T : average 96Gi08=1.57(0.07) 93Al03=1.48(0.02) 83Ga.A=1.58(0.05) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{132}Ag	−34400#	500#				30	ms	14	6^-#	15	15Lo04	TD	2015	β^-=100;β^-n ?;β^-2n ?	*
^{132}Cd	−50470	60				84	ms	5	0^+	18	00Ha55	TD	2000	β^-=100;β^-n=60 15;β^-2n ?	*
^{132}In	−62410	60				202.2	ms	0.2	(7^-)	18	20Be16	TD	1973	β^-=100;β^-n=12.3 4;β^-2n ?	*
^{132}Sn	−76546.6	2.0				39.7	s	0.8	0^+	18			1963	β^-=100	
^{132}Sn^m	−71698.1	2.0	4848.52	0.20		2.080	μs	0.016	8^+	18	17Ch51	T	1986	IT=100	*
^{132}Sb	−79635.3	2.5				2.79	m	0.07	$(4)^+$	18			1956	β^-=100	
^{132}Sb^m	−79490#	50#	150#	50#		4.10	m	0.05	(8^-)	18	89St06	E	1956	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{132}Sb^{n}	−79380.8	2.5	254.5	0.3		102 ns 4	(6$^-$)	18			1974	IT=100	
^{132}Te	−85188	3				3.204 d 0.013	0$^+$	05			1948	β^-=100	
^{132}Te^{m}	−83413	3	1774.80	0.09		145 ns 8	6$^+$	05			1973	IT=100	
^{132}Te^{n}	−83263	3	1925.47	0.09		28.5 μs 0.9	7$^-$	05	17Ki09	T	1979	IT=100	*
^{132}Te^{p}	−82465	3	2723.3	0.8		3.62 μs 0.06	(10$^+$)	05	17Ki09	T	1979	IT=100	*
^{132}I	−85704	4				2.295 h 0.013	4$^+$*	05			1948	β^-=100	
^{132}I^{m}	−85594	10	110	11	BD	1.387 h 0.015	(8$^-$)	05			1973	IT=86 2;β^-=14 2	
^{132}Xe	−89278.975	0.005				STABLE	0$^+$	05			1920	IS=26.909 55	
^{132}Xe^{m}	−86526.77	0.17	2752.21	0.17		8.39 ms 0.11	(10$^+$)	05			1976	IT=100	
^{132}Cs	−87152.7	1.0				6.480 d 0.006	2$^+$*	05			1953	β^+=98.13 9;β^-=1.87 9	
^{132}Ba	−88434.9	1.1				STABLE >300Ey	0$^+$	05	96Ba24	T	1936	IS=0.10 1;2β^+ ?	
^{132}La	−83720	40				4.59 h 0.04	2$^-$*	05	18Ab02	T	1951	β^+=100	
^{132}La^{m}	−83530	40	188.20	0.11		24.3 m 0.5	6$^-$*	05			1969	IT=76;β^+=24	
^{132}Ce	−82469	20				3.51 h 0.11	0$^+$	05			1960	β^+=100	
^{132}Ce^{m}	−80128	20	2341.15	0.21		9.4 ms 0.3	8$^-$	05	09Pe31	J	1969	IT=100	
^{132}Pr	−75227	29			*	1.49 m 0.11	(2$^+$)	05	94Bu18	TJ	1974	β^+=100	*
^{132}Pr^{m}	−75200#	40#	30#	30#	*	1# s	(5$^+$)	05	90Ko25	J	1990	β^+ ?;IT ?	
^{132}Pr^{n}	−74980#	40#	250#	30#		2.46 μs 0.04	(8$^+$)		12Ta18	TJD	2012	IT=100	*
^{132}Pr^{p}	−74930#	40#	300#	30#		486 ns 70	(8$^-$)		12Ta18	TJD	2012	IT=100	*
^{132}Nd	−71426	24				1.56 m 0.10	0$^+$	05	95Bu11	T	1977	β^+=100	*
^{132}Pm	−61630#	150#				6.2 s 0.6	(3$^+$)	05			1977	β^+=100;β^+p≈5e-5	
^{132}Sm	−55140#	300#				4.0 s 0.3	0$^+$	05			1989	β^+=100;β^+p ?	
^{132}Eu	−42200#	400#				100# ms	1$^+$#	05	93Li40	D		β^+ ?;β^+p ?;p=0	

*^{132}Ag	T : symmetrized from 15Lo04=28(+15-12)	**
*^{132}Cd	T : average 15Lo04=82(4) 00Ha55,01Ha39=97(10)	**
*^{132}In	T : others: 20Wh02=194(5) 15Lo04=198(2) 02Di12=206(6) 93Ru01=221(11)	**
*^{132}In	T : 86Wa17=204(6), 85Re.A=204(6) (same as 86Wa17) 86Bj01=186(22)	**
*^{132}In	D : %β^-n average 20Wh02=12.3(0.4) 20Be16=12(2) 93Ru01=10.7(3.3); others:	**
*^{132}In	D : 86ReZU=6.8(1.4) 80Lu04=4.2(0.9)	**
*^{132}Sn^{m}	T : average 17Ch51=2.15(0.16) 12Ka36=2.088(0.017) 94Fo14=2.03(4);	**
*^{132}Sn^{m}	T : other 82Ka25=1.7(2)	**
*^{132}Te^{n}	T : average 17Ki09=28.6(+1.2-1.1) 79Si08=28.1(1.5)	**
*^{132}Te^{n}	J : E1 to 6+	**
*^{132}Te^{p}	T : average 17Ki09=3.52(0.09) 01Ge07=3.70(0.09) 79Si08=3.9(0.3)	**
*^{132}Pr	T : average 94Bu18=1.47(0.12) 74Ar27=1.6(0.3)	**
*^{132}Pr^{n}	E : 12Ta18=219.9(0.2) keV above ^{132}Pr^{m}	**
*^{132}Pr^{p}	E : 12Ta18=273.0(0.6) keV above ^{132}Pr^{m}	**
*^{132}Nd	T : average 95Bu11=1.47(0.12) 77Bo02=1.75(0.17)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{133}Ag	−29080#	500#					9/2$^+$#					β^- ?;β^-n ?	
^{133}Cd	−44140#	200#				61 ms 6	7/2$^-$#	11	15Lo04	T	2010	β^-=100;β^-n=?;β^-2n ?	*
^{133}In	−57690#	200#				163.0 ms 1.6	(9/2$^+$)	11	20Be16	TD	1996	β^-=100;β^-n=90 3;β^-2n ?	*
^{133}In^{m}	−57360#	200#	330#	40#		167 ms 11	(1/2$^-$)	11	20Be16	TD	1996	β^-=100;β^-n=93 3	*
^{133}Sn	−70873.9	1.9				1.37 s 0.07	7/2$^-$*	11	93Ru01	TD	1973	β^-=100;β^-n=0.0294 24	*
^{133}Sb	−78924	3				2.34 m 0.05	(7/2$^+$)	11			1966	β^-=100	
^{133}Sb^{m}	−74383	9	4541	9		16.54 μs 0.19	(21/2$^+$)	11	16Bo19	E	1978	IT=100	*
^{133}Te	−82937.1	2.1				12.5 m 0.3	3/2$^+$#	11			1940	β^-=100	
^{133}Te^{m}	−82602.8	2.1	334.26	0.04		55.4 m 0.4	(11/2$^-$)	11			1957	β^-=83.5 20;IT=16.5 20	
^{133}Te^{n}	−81326.7	2.2	1610.4	0.5		100 ns 5	(19/2$^-$)	11			2001	IT=100	
^{133}I	−85857	6				20.83 h 0.08	7/2$^+$*	11			1940	β^-=100	
^{133}I^{m}	−84223	6	1634.148	0.010		9 s 2	(19/2$^-$)	11			1970	IT=100	
^{133}I^{n}	−84128	6	1729.137	0.010		∼ 170 ns	(15/2$^-$)	11			1984	IT=100	
^{133}I^{p}	−83363	6	2493.7	0.4		469 ns 15	(23/2$^+$)	11			2009	IT=100	
^{133}Xe	−87643.6	2.4				5.2474 d 0.0005	3/2$^+$*	11	FGK209	T	1940	β^-=100	
^{133}Xe^{m}	−87410.4	2.4	233.221	0.015		2.198 d 0.013	11/2$^-$*	11	90NeZY	J	1951	IT=100	*
^{133}Xe^{n}	−85497#	20#	2147#	20#		8.64 ms 0.13	(23/2$^+$)	11	17Vo06	EJ	2017	IT=100	*
^{133}Cs	−88070.943	0.008				STABLE	7/2$^+$*	11			1921	IS=100	
^{133}Ba	−87553.5	1.0				10.5379 y 0.0016	1/2$^+$*	11	FGK209	T	1941	ε=100	
^{133}Ba^{m}	−87265.2	1.0	288.252	0.009		38.90 h 0.06	11/2$^-$*	11	12Da04	T	1941	IT=99.9896 4;ε=0.0104 5	*
^{133}La	−85494	28				3.912 h 0.008	5/2$^+$*	11			1950	β^+=100	
^{133}Ce	−82418	16				97 m 4	1/2$^+$*	11			1951	β^+=100	
^{133}Ce^{m}	−82381	16	37.2	0.7		5.1 h 0.3	9/2$^-$*	11			1951	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{133}Pr	−77938	12				6.5	m	0.3	5/2$^+$*	11			1970	β^+=100	
^{133}Pr^m	−77746	12	192.12	0.14		1.1	s	0.2	(11/2$^-$)	11			1995	IT=100	
^{133}Nd	−72330	50				70	s	10	(7/2$^+$)	11			1977	β^+=100	
^{133}Nd^m	−72200	50	127.97	0.12		∼70	s		(1/2)$^+$	11	95Br24	DT	1993	β^+=?;IT=?	
^{133}Nd^n	−72150	50	176.10	0.10		301	ns	18	(9/2$^-$)	11			1993	IT=100	
^{133}Pm	−65410	50				13.5	s	2.1	(3/2$^+$)	11			1977	β^+=100	
^{133}Pm^m	−65280	50	129.7	0.7		8#	s		(11/2$^-$)	11			1996	β^+ ?;IT ?	
^{133}Sm	−57230#	300#				2.89	s	0.16	(5/2$^+$)	11			1977	β^+=100;β^+p=?	
^{133}Sm^m	−57110#	310#	120#	60#		3.5	s	0.4	(1/2$^-$)	11			1993	β^+=?;IT ?;β^+p ?	
^{133}Eu	−47240#	300#				200#	ms		5/2$^+$#					β^+ ?;β^+p ?	
^{133}Gd	−36060#	500#				10#	ms		5/2$^+$#					β^+ ?;β^+p ?	
*^{133}Cd	T : average 15Lo04=64(8) 05Kr20=57(10)														**
*^{133}Cd	D : β^-n was observed in 05Kr20, but it was not quantified														**
*^{133}In	T : average 19Pi04,20Be16=162(2) 15Lo04=163(7) 02Di12=165(3);														**
*^{133}In	T : other: 96Ho16=180(15)														**
*^{133}In	D : %β^-n from 20Be16, supersedes 19Pi04=74(5) (same experiment);														**
*^{133}In	D : other: 96Ho16=85(10)														**
*^{133}In^m	T : from 19Pi04,20Be16=167(11)														**
*^{133}In^m	D : %β^-n from 20Be16, supersedes 19Pi04=80(5) (same experiment);														**
*^{133}Sn	T : average 06KeZZ=1.57(0.14) 93Ru01=1.20(0.05) 78Si05=1.37(0.07)														**
*^{133}Sn	T : 73Bo42=1.47(0.04), Birge ratio=2.57														**
*^{133}Sn	J : 20Ro19=7/2														**
*^{133}Sb^m	E : from 4526+x keV above gs, with x<30 keV in 16Bo19														**
*^{133}Xe^m	J : 90NeZY=11/2														**
*^{133}Xe^n	E : from 2107+x keV in 17Vo06; x=40#(20#) estimated by Nubase														**
*^{133}Xe^n	T : from 18Ka47														**
*^{133}Ba^m	T : average 12Da04=38.88(0.08) 11Gr01=38.92(0.09)														**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{134}Cd	−39460#	300#				65	ms	15	0$^+$	15			2015	β^-=100;β^-n ?;β^-2n ?	
^{134}In	−51970#	200#				136	ms	4	7$^-$#	04	15Lo04	T	1996	β^-=100;β^-n≈65;β^-2n<4	*
^{134}In^m	−51910#	200#	56.7	0.1		3.5	μs	0.4	(5$^-$)		19Ph02	ETJ	2019	IT=100	
^{134}Sn	−66434	3				0.93	s	0.08	0$^+$	04	75As04	TD	1974	β^-=100;β^-n=17 13	*
^{134}Sn^m	−65187	3	1247.4	0.5		87	ns	8	6$^+$	04	12Ka36	T	2000	IT=100	*
^{134}Sb	−74019	3				674	ms	4	(0$^-$)	11	18Si28	T	1967	β^-=100;β^-n ?	
^{134}Sb^m	−73740	3	279	1		10.01	s	0.04	(7$^-$)	11	18Si28	T	1968	β^-=100;β^-n=0.088 4	*
^{134}Te	−82533.8	2.7				41.8	m	0.8	0$^+$	04			1948	β^-=100	
^{134}Te^m	−80842.5	2.7	1691.34	0.16		164.5	ns	0.7	6$^+$	04	17Ur03	T	1970	IT=100	*
^{134}I	−84043	5				52.5	m	0.2	(4)$^+$	04			1948	β^-=100	
^{134}I^m	−83727	5	316.49	0.22		3.52	m	0.04	(8)$^-$	04			1970	IT=97.7 10;β^-=2.3 10	
^{134}Xe	−88125.834	0.006				STABLE		>11Py	0$^+$	04	89Ba22	T	1920	IS=10.436 35;2β^- ?	*
^{134}Xe^m	−86160.3	0.5	1965.5	0.5		290	ms	17	7$^-$	04			1968	IT=100	
^{134}Xe^n	−85100.6	1.5	3025.2	1.5		5	μs	1	(10$^+$)	04			2001	IT=100	
^{134}Cs	−86891.165	0.016				2.0650	y	0.0004	4$^+$*	04	FGK209	T	1940	β^-=100;ε=0.00030 12	*
^{134}Cs^m	−86752.421	0.016	138.7441	0.0026		2.912	h	0.002	8$^-$*	04			1975	IT=100	
^{134}Ba	−88950.00	0.25				STABLE			0$^+$	04			1936	IS=2.42 15	
^{134}Ba^m	−85992.8	0.6	2957.2	0.5		2.61	μs	0.13	10$^+$	04	19Ka36	JT	1982	IT=100	*
^{134}La	−85219	20				6.45	m	0.16	1$^+$	04			1951	β^+=100	
^{134}La^m	−84780#	100#	440#	100#		29	μs	4	(6$^-$)	04			1985	IT=100	*
^{134}Ce	−84833	20				3.16	d	0.04	0$^+$	04			1951	ε=100	
^{134}Ce^m	−81624	20	3208.6	0.4		308	ns	5	10$^+$	04			1980	IT=100	
^{134}Pr	−78528	20				17	m	2	2$^-$*	04			1967	β^+=100	
^{134}Pr^m	−78460	20	67.7	0.4		∼11	m		6$^-$	04	11Ti10	EJ	1973	β^+=100	*
^{134}Nd	−75646	12				8.5	m	1.5	0$^+$	04			1970	β^+=100	
^{134}Nd^m	−73353	12	2293.0	0.4		389	μs	17	8$^-$	04	17Pe03	TJ	1969	IT=100	*
^{134}Pm	−66760	40			*&	22	s	1	(5$^+$)	04			1977	β^+=100	
^{134}Pm^m	−66710#	60#	50#	50#	*&	∼5	s		(2$^+$)	04			1988	β^+=100	
^{134}Pm^n	−66640#	60#	120#	50#		20	μs	1	(7$^-$)		09Cu02	TJ	2009	IT=100	*
^{134}Sm	−61380#	200#				9.5	s	0.8	0$^+$	04			1977	β^+=100	
^{134}Eu	−49800#	300#				500	ms	200		04			1989	β^+=100;β^+p=?	
^{134}Gd	−41530#	400#				400#	ms		0$^+$	04				β^+ ?;β^+p ?	
*^{134}In	T : average 15Lo04=126(7) 02Di12=141(5) 96Ho16=138(8)														**
*^{134}In	D : %β^-n from 96Ho16; %β^-2n intensity limit from 95Jo.A														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{134}Sn T : unweighted average 93Ru01t=1.050(0.011) 75As04=0.7(0.2) 15Lo04=0.89(0.2) **
*^{134}Sn T : 20Wu04=1.07(0.27); Birge ratio=4.15; others 90Fo03=1.2(0.1) **
*^{134}Sn T : 76Lu02=1.04(0.02) 02Pf04=1.12(0.08), compilation **
*^{134}Sn^m T : symmetrized from 12Ka36=86(+8-7); other 00Ko15=80(15) **
*^{134}Sb^m T : average 18Si28=9.87(0.08) 93Ru01=10.07(0.05) **
*^{134}Te^m T : average 17Ur03=165.1(1.0) 01Mi22=165(6) 95Om01=164(1) 70Jo20=163(7) **
*^{134}Te^m T : 74ClZX=163(4) 74Su04=170(4) 76ChZD=161(4); others 17Ki09=190(10) **
*^{134}Te^m T : 74Bl03=196(7) 04Hw02=197(20) **
*^{134}Xe T : others 0nu-BB 89Ba22>58Zy and >26Zy for 0+->0+ and 0+->2+ respectively **
*^{134}Cs D : %ε from 75Va12 **
*^{134}Ba^m T : average 19Ka36=2.51(0.30) 82BeZY=2.63(0.14) **
*^{134}La^m E : from 336.44(17)+x keV; x=100#(100#) keV estimated by Nubase **
*^{134}Pr^m E : from a least-squares fit to the level scheme of 11Ti10 **
*^{134}Nd^m T : average 17Pe03=380(20) 72Pa26=410(30) **
*^{134}Pm^n E : 70.7(0.2) keV above a 6+ state that decays via a low-energy gamma to 5+ **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{135}Cd	−32820#	400#						5/2$^-$#					β^- ?;β^-n ?	
^{135}In	−47110#	300#			103	ms	3	9/2$^+$#	16	20PhZZ	TD	2002	β^-=100;β^-n= ?;β^-2n ?	*
^{135}Sn	−60632	3			515	ms	5	7/2$^-$#	16	15Lo04	T	1994	β^-=100;β^-n=21 3;β^-2n ?	
^{135}Sb	−69690.3	2.6			1.668	s	0.009	(7/2$^+$)	16	20Wa04	D	1964	β^-=100;β^-n=19.1 5	*
^{135}Te	−77728.8	1.7			19.0	s	0.2	(7/2$^-$)	08			1969	β^-=100	
^{135}Te^m	−76173.9	1.7	1554.89	0.16	511	ns	20	(19/2$^-$)	08			1980	IT=100	
^{135}I	−83779.2	2.1			6.58	h	0.03	7/2$^+$*	08			1940	β^-=100	
^{135}Xe	−86413	4			9.14	h	0.02	3/2$^+$	08			1940	β^-=100	
^{135}Xe^m	−85886	4	526.551	0.013	15.29	m	0.05	11/2$^-$*	08	90NeZY	J	1960	IT≈100;β^-=0.30 17	*
^{135}Cs	−87582.0	0.4			1.33	My	0.19	7/2$^+$*	08	16Ma05	T	1949	β^-=100	*
^{135}Cs^m	−85949.1	1.6	1632.9	1.5	53	m	2	19/2$^-$*	08			1962	IT=100	
^{135}Ba	−87850.65	0.25			STABLE			3/2$^+$*	08			1932	IS=6.59 10	
^{135}Ba^m	−87582.43	0.25	268.218	0.020	28.11	h	0.02	11/2$^-$	08	12Da04	T	1948	IT=100	
^{135}Ba^n	−85462.7	0.6	2388.0	0.5	1.06	ms	0.04	(23/2$^+$)		18Ka47	ETJ	2018	IT=100	
^{135}La	−86643	9			18.91	h	0.02	5/2$^+$*	08	18Ab02	T	1948	β^+=100	
^{135}Ce	−84616	10			17.7	h	0.3	1/2$^+$*	08			1948	β^+=100	
^{135}Ce^m	−84170	10	445.81	0.21	20	s	1	(11/2$^-$)	08			1963	IT=100	
^{135}Pr	−80936	12			24	m	1	3/2$^+$*	08			1954	β^+=100	*
^{135}Pr^m	−80578	12	358.06	0.06	105	μs	10	(11/2$^-$)	08			1973	IT=100	
^{135}Nd	−76214	19			12.4	m	0.6	9/2$^-$*	08			1970	β^+=100	
^{135}Nd^m	−76149	19	64.95	0.24	5.5	m	0.5	(1/2$^+$)	08			1970	β^+≈100;IT ?	
^{135}Pm	−70060	80			49	s	3	(3/2$^+$,5/2$^+$)	08			1975	β^+=100	
^{135}Pm^m	−69830#	50#	240#	100#	40	s	3	(11/2$^-$)	08	89Ko07	TJ	1989	β^+=100	*
^{135}Sm	−62860	150			10.3	s	0.5	(7/2$^+$)	08	77Bo02	J	1977	β^+=100;β^+p=0.02 1	
^{135}Eu	−54150#	200#			1.5	s	0.2	5/2$^+$#	16			1989	β^+=100;β^+p ?	
^{135}Gd	−44250#	400#			1.1	s	0.2	(5/2$^+$)	16			1996	β^+=100;β^+p≈2	
^{135}Tb	−33050#	400#			1.01	ms	0.28	(7/2$^-$)	16			2004	p≈100;β^+ ?	*

*^{135}In T : average 20PhZZ=104(4) 15Lo04=103(5) 02Di12=92(10) **
*^{135}In D : β^-n was observed in 02Di12 and 20PhZZ, but was not quantified **
*^{135}Sb D : %β^-n average 20Wa04=14.6(0.4,stat)(1.2,syst) 17AgZZ=24.5(1.0) **
*^{135}Sb D : 93Ru01=21.0(1.1) 02Sh08=22(3) 78Cr03=14(1) 93Ru01=22(4), **
*^{135}Sb D : supersedes 77Ru04=19.9(2.1); Birge ratio=3.46 **
*^{135}Sb T : average 93Ru01=1.662(0.010) 68To18=1.696(0.021); other (recent) **
*^{135}Sb T : 20Wu04=1.57(0.23), outweighed **
*^{135}Xe^m D : %β^- ranging from 0.004% to 0.6% **
*^{135}Xe^m J : 90NeZY=11/2 **
*^{135}Cs T : average 16Ma05=1.6(0.6) by AMS and 1.3(0.2) ICPMS **
*^{135}Pr J : 19Fr08,72Ek04=3/2 **
*^{135}Pm^m E : from TNN of 11/2- level in Pm isotopes: ^{133}Pm: 130 keV **
*^{135}Pm^m E : ^{137}Pm: 150(50) keV ^{139}Pm: 189 keV ^{141}Pm: 629 keV **
*^{135}Tb T : symmetrized from 04Wo07=940(+330-220) us **

^{136}In	−40970#	300#			86	ms	9	7$^-$#	18	15Lo04	TD	2015	β^-=100;β^-n ?;β^-2n ?	*
^{136}Sn	−56170#	200#			355	ms	18	0$^+$	18	20Ju02	T	1994	β^-=100;β^-n=28 3;β^-2n ?	*
^{136}Sb	−64507	6			923	ms	14	(1$^-$)	18	20Wa04	D	1976	β^-=100;β^-n=24.7 5;	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
														β^-2n=0.14 3	
^{136}Sb^m	−64238	6	269.3	0.5		570	ns	5	(6$^-$)	18	12Ka36	T	2001	IT=100	*
^{136}Te	−74425.3	2.3				17.63	s	0.09	0$^+$	18	18Ca22	D	1974	β^-=100;β^-n=1.37 4	*
^{136}I	−79545	14				83.4	s	0.4	(1$^-$)	18			1949	β^-=100	
^{136}I^m	−79339	5	206	15	BD	46.6	s	1.1	(6$^-$)	18			1959	β^-=100	
^{136}Xe	−86429.170	0.007				2.18	Zy	0.05	0$^+$	18	20Ba.A	T	1920	IS=8.857 72;2β^-=100	*
^{136}Xe^m	−84537.43	0.07	1891.74	0.07		2.92	μs	0.03	6$^+$	18	17Ki09	T	1969	IT=100	*
^{136}Cs	−86338.9	1.9				13.01	d	0.05	5$^+$*	18			1951	β^-=100	*
^{136}Cs^m	−85821.0	1.9	517.9	0.1		17.5	s	0.2	8$^-$*	18			1981	IT=?;β^- ?	*
^{136}Ba	−88887.08	0.24				STABLE			0$^+$	18			1932	IS=7.85 24	
^{136}Ba^m	−86856.55	0.24	2030.535	0.018		308.4	ms	1.9	7$^-$	19			1965	IT=100	
^{136}Ba^n	−85529.9	0.3	3357.19	0.25		91	ns	2	10$^+$	19			2004	IT=100	
^{136}La	−86040	50				9.87	m	0.03	1$^+$*	19			1950	β^+=100	*
^{136}La^m	−85780	50	259.5	0.3		114	ms	5	(7$^-$)	19			1966	IT=100	
^{136}La^n	−83520	50	2520.6	0.4		187	ns	27	(14$^+$)	19			2015	IT=100	
^{136}Ce	−86508.5	0.3				STABLE		>32Py	0$^+$	19	11Be02	T	1936	IS=0.186 2;2β^+ ?	*
^{136}Ce^m	−83413.5	0.7	3095.0	0.6		1.96	μs	0.09	10$^+$	19	13Va10	T	1991	IT=100	*
^{136}Pr	−81340	11				13.1	m	0.1	2$^+$*	19			1968	β^+=100	*
^{136}Nd	−79199	12				50.65	m	0.33	0$^+$	19			1968	β^+=100	
^{136}Pm	−71170	70			*	107	s	6	7$^+$#	19	73PaZV	T	1988	β^+=100	*
^{136}Pm^m	−71070	90	100	120	MD*	90	s	35	2$^+$#	19	89Vi04	T	1982	β^+=100	*
^{136}Pm^n	−71130	70	42.7	0.2		1.5	μs	0.1	7$^-$#	19	08Ri05	ET	1987	IT=100	*
^{136}Sm	−66811	12				47	s	2	0$^+$	19			1982	β^+=100	
^{136}Sm^m	−64546	12	2264.7	1.1		15	μs	1	(8$^-$)	19			1994	IT=100	
^{136}Eu	−56240#	200#			*	3.3	s	0.3	6$^+$#	19			1987	β^+=100;β^+p≈0.09	*
^{136}Eu^m	−56140#	220#	100#	100#	*	3.8	s	0.3	1$^+$#	19			1987	β^+=100;β^+p≈0.09	*
^{136}Gd	−49090#	300#				1#	s	>200ns	0$^+$	19			2000	β^+ ?;β^+p ?	
^{136}Tb	−35900#	500#				200#	ms		5$^-$#	19				β^+ ?;β^+p ?	

*^{136}In T : symmetrized from 15Lo04=85(+10-8) **
*^{136}Sn D : %β^-n average 11Ar18=27(4) 02Sh08=30(5) **
*^{136}Sn T : average 20Ju02=361(5) (supersedes 15Lo04=350(5)) 11Ar18=300(15); **
*^{136}Sn T : Birge ratio=3.86 **
*^{136}Sb D : %β^-n average 20Wa04=17.6(1.0,stat)(2.7,syst) 18Ca22=32.2(1.5) **
*^{136}Sb D : 15CaZM=19.2(1.8) 93Ru01=16.3(3.2); Birge ratio=3.97; %β^-2n from 18Ca22 **
*^{136}Sb^m T : others 15Lo08=489(40) 07Si27=480(100) 01Mi22=570(50) **
*^{136}Te D : %β^-n average 18Ca22=1.47(0.06) 93Ru01=1.31(0.05) 12Ma63=1.34(0.13) **
*^{136}Xe T : value for 2ν-$\beta\beta$; other 19Ga11=2.23(0.08) 14Al03=2.165(0.061) **
*^{136}Xe T : 12Ga17=2.38(0.14) 15Ba11=2.19(0.06) (evaluation); 0nu-BB: 18Al05>18 Yy **
*^{136}Xe T : 16As01>2.5 Yy 13Ga07>19 Yy 12Au03>16 Yy 02Be74>10Zy (all at 90% C.L.) **
*^{136}Xe^m T : average 17Ki09=2.92(0.03) 70Jo20=2.80(0.37), 3.40(0.35) **
*^{136}Xe^m T : 74ClZX=2.78(0.17), 3.35(0.47) 70Ca25=2.8(0.2),3.0(0.3) **
*^{136}Xe^m T : 70Gr38=3.10(0.38) 69Wa29=3.4(0.4) **
*^{136}Cs J : 81Th06,76Fu06,71Da01=5 **
*^{136}Cs^m J : 81Th06=8 **
*^{136}Cs^m E : also 83We07=518(5) **
*^{136}La J : 76Fu06,73In04=1 **
*^{136}Ce T : for 2K cature-2nu; see also 17Be21 **
*^{136}Ce^m T : average 13Va10=1.9(0.1) 75Yo01=2.2(0.2) **
*^{136}Pr J : 19Fr08,76Fu06,72Ek04=2 **
*^{136}Pm J : expected conf=p5/2[532] n9/2[514],K=7+ (prolate shape); supported by the **
*^{136}Pm J : observed direct feeding to I=6,7 levels following ^{136}Pm β^+ decay **
*^{136}Pm^m T : from 30 s < T1/2 <150 s in 89Vi04; other 88Ke03=300(50)s, but according **
*^{136}Pm^m T : to the authors the value is poorly defined **
*^{136}Pm^m J : expected p5/2[532] n9/2[514],K=2+ (prolate shape); supported by the **
*^{136}Pm^m J : observed direct feeding to I=2,3 levels following ^{136}Pm β^+ decay **
*^{136}Pm^n E : 08Ri05=42.7(0.2) keV above a long lived state that could be either the **
*^{136}Pm^n E : gs or the isomer **
*^{136}Pm^n J : expected conf=p5/2[413] n9/2[514],K=7- (prolate shape); 42.7g E1, **
*^{136}Pm^n J : consistent with the measured half-life **
*^{136}Eu J : expected conf=p5/2[413] n7/2[404],K=6+ (prolate shape) **
*^{136}Eu J : expected conf=p5/2[413] n7/2[404],K=1+ (prolate shape) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{137}In	−35830#	400#					70	ms	40	$9/2^+$#	15	15Lo04	TD	2015	β^-=100;β^-n ?;β^-2n ?	*
^{137}Sn	−50150#	300#					249	ms	15	$5/2^-$#	07	11Ar18	TD	1994	β^-=100;β^-n=48 6;β^-2n ?	*
^{137}Sb	−60060	50					497	ms	21	$7/2^+$#	07	20Wu04	T	1994	β^-=100;β^-n=49 6;β^-2n ?	*
^{137}Te	−69303.8	2.1					2.49	s	0.05	$3/2^-$#	07	17AgZZ	D	1975	β^-=100;β^-n=2.94 14	*
^{137}I	−76356	8					24.13	s	0.12	$7/2^+$#	07	20Cz01	D	1943	β^-=100;β^-n=7.51 11	*
^{137}Xe	−82383.41	0.10					3.818	m	0.013	$7/2^-$*	07	89Bo03	J	1943	β^-=100	*
^{137}Cs	−86545.8	0.3					30.04	y	0.04	$7/2^+$*	07	FGK204	T	1951	β^-=100	
^{137}Ba	−87721.40	0.25					STABLE			$3/2^+$*	07			1932	IS=11.23 23	
^{137}Ba^m	−87059.74	0.25	661.659	0.003			2.552	m	0.001	$11/2^-$*	07			1965	IT=100	
^{137}Ba^n	−85372.3	0.6	2349.1	0.5			589	ns	20	$(19/2^-)$	07	17Vo01	T	1973	IT=100	*
^{137}La	−87140.9	1.6					60	ky	20	$7/2^+$*	07			1948	ε=100	
^{137}La^m	−85271.4	1.6	1869.50	0.21			342	ns	25	$19/2^-$	07			1982	IT=100	
^{137}Ce	−85918.8	0.4					9.0	h	0.3	$3/2^+$*	07			1948	β^+=100	
^{137}Ce^m	−85664.5	0.4	254.29	0.05			34.4	h	0.3	$11/2^-$*	07			1958	IT=99.21 4;β^+=0.79 4	
^{137}Pr	−83202	8					1.28	h	0.03	$5/2^+$*	07			1958	β^+=100	*
^{137}Pr^m	−82641	8	561.22	0.23			2.66	μs	0.07	$11/2^-$	07			1987	IT=100	
^{137}Nd	−79584	12					38.5	m	1.5	$1/2^+$*	07			1970	β^+=100	
^{137}Nd^m	−79065	12	519.43	0.20			1.60	s	0.15	$11/2^-$	07			1970	IT=100	
^{137}Pm	−74073	13				&	2#	m		$5/2^-$#				1975	β^+ ?	
^{137}Pm^m	−73910	40	160	50	BD	&	2.4	m	0.1	$11/2^-$	07			1973	β^+=100	
^{137}Sm	−67992	29					45	s	1	$(9/2^-)$	07			1986	β^+=100	
^{137}Sm^m	−67890#	60#	100#	50#			20#	s		$1/2^+$#					β^+ ?	
^{137}Eu	−60146	4					8.4	s	0.5	$5/2^+$#	07	88Be.A	T	1982	β^+=100	
^{137}Gd	−51210#	300#					2.2	s	0.2	$(7/2)(^+$#$)$	07			1999	β^+=100;β^+p=?	
^{137}Tb	−40970#	400#					600#	ms		$3/2^+$#					p ?;β^+ ?	

*^{137}In T : symmetrized from 15Lo04=65(+40-30) **
*^{137}Sn T : average 11Ar18=273(7) 20Wu04=204(12) 20Ju02t=238(8), supersedes **
*^{137}Sn T : 15Lo04=230(30), 02Sh08=190(60); Birge ratio=3.09 **
*^{137}Sn D : %β^-n average 11Ar18=50(8) 02Sh08=58(15) 20Ju02d=32(15) **
*^{137}Sb T : average 20Wu04=566(52) 11Ar18=492(25) 02Sh08=450(50) **
*^{137}Sb D : %β^-n average 11Ar18=49(8)% 02Sh08=49(10)% **
*^{137}Te J : TNN of N=85 isotones. Ensdf2007=(7/2-) from shell-model prediction **
*^{137}Te D : %β^-n average 17AgZZ=2.6(0.3) 93Ru01=3.04(0.16) **
*^{137}I T : from 93Ru01, supersedes 74Ru08=24.5(0.2) (same group) **
*^{137}I D : %β^-n average 20Cz01=6.66(0.34) 17Ra10=7.9(0.5) 16Ag03=7.76(0.14) **
*^{137}I D : 93Ru01=7.14(0.23) **
*^{137}Xe J : 89Bo03,90NeZY=7/2 **
*^{137}Ba^n J : from 19Ka04 **
*^{137}Pr J : 19Fr08,72Ek04=3/2 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{138}Sn	−45510#	400#				148	ms	9	0^+	17	20Wu04	T	2010	β^-=100;β^-n=36 12;β^-2n ?	*
^{138}Sn^m	−44170#	400#	1344	2		210	ns	45	(6^+)	17			2014	IT=100	
^{138}Sb	−54650#	300#				333	ms	7	(3^-)	17	20Wu04	T	1994	β^-=100;β^-n=72 8;β^-2n ?	*
^{138}Te	−65696	4				1.46	s	0.25	0^+	17	20Wu04	T	1975	β^-=100;β^-n=4.80 23	*
^{138}I	−71980	6				6.26	s	0.03	(1^-)	17	20Cz01	D	1949	β^-=100;β^-n=5.33 11	*
^{138}I^m	−71912	6	67.9	0.3		1.26	μs	0.16	(3^-)	17			2007	IT=100	
^{138}Xe	−79972.2	2.8				14.14	m	0.07	0^+	17			1943	β^-=100	
^{138}Cs	−82887	9				33.5	m	0.2	3^-*	17			1943	β^-=100	*
^{138}Cs^m	−82807	9	79.9	0.3		2.91	m	0.10	6^-*	17			1971	IT=81 3;β^-=19 3	*
^{138}Cs^x	−82847	25	40	23		$R=?$			*fsmix*						
^{138}Ba	−88261.81	0.25				STABLE			0^+	17			1925	IS=71.70 29	
^{138}Ba^m	−86171.27	0.25	2090.536	0.021		850	ns	100	6^+	17			1971	IT=100	
^{138}La	−86513.4	0.4				103	Gy	1	5^+*	17			1947	IS=0.0 8881;β^+=65.5 4; β^-=34.5 4	*
^{138}La^m	−86440.8	0.4	72.57	0.03		116	ns	5	$(3)^+$	17			1975	IT=100	
^{138}La^n	−85774.6	0.4	738.80	0.20		2.0	μs	0.3	7^-	17	14As02	TJ	2014	IT=100	
^{138}Ce	−87565.9	0.5				STABLE	>44Py		0^+	17			1936	IS=0.251 2;2β^+ ?	*
^{138}Ce^m	−85436.6	0.5	2129.28	0.12		8.73	ms	0.20	7^-	17			1960	IT=100	
^{138}Pr	−83129	10				1.45	m	0.05	1^+	17			1951	β^+=100	
^{138}Pr^m	−82779	16	350	19	BD	2.12	h	0.04	7^-*	17			1958	β^+=100	*
^{138}Nd	−82017	12				5.04	h	0.09	0^+	17			1965	β^+=100	
^{138}Nd^m	−78843	12	3174.5	0.4		370	ns	5	10^+	17			1975	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{138}Pm	−74914	12				3.24	m	0.05	3^-#	17			1973	β^+=100	*
^{138}Pm^m			*non − exist*		EU	10	s	2	1^+#	17	83Al06	IT		β^+=100	*
^{138}Sm	−71498	12				3.1	m	0.2	0^+	17			1982	β^+=100	
^{138}Eu	−61750	28			*&	5#	s		2^-#	17	FGK205	EJ	1982	β^+ ?	*
^{138}Eu^m	−61650#	60#	100#	50#	*&	12.1	s	0.6	7^-#	17	FGK205	EJ	1982	β^+=100	*
^{138}Gd	−55660#	200#				4.7	s	0.9	0^+	17			1985	β^+=100	
^{138}Gd^m	−53430#	200#	2232.6	1.1		6.2	μs	0.2	(8^-)	17			1997	IT=100	
^{138}Tb	−43600#	300#				800#	ms	>200ns	2^+#	17			1993	β^+ ?;β^+p ?;p=0	
^{138}Dy	−34930#	500#				200#	ms		0^+					β^+ ?;β^+p ?	

*^{138}Sn T : average 20Wu04=158(15) 20Ju02t=142(12), supersedes 15Lo04=140(+30-20) **
*^{138}Sb T : average 20Wu04=326(8) 15Le14=346(19) 11Ar18=350(15) **
*^{138}Te D : %β^-n from 17AgZZ; other 75As04=6.3(2.1) **
*^{138}Te T : average 20Wu04=1.50(0.32) 75As04=1.4(0.4); other 06KeZZ=1.151(0.028) **
*^{138}I D : %β^-n average 20Cz01=6.07(0.34) 17AgZZ=4.98(0.18) 11Go37=5.32(0.20) **
*^{138}I D : 93Ru01=5.56(0.22) **
*^{138}Cs J : 67St22,78Sc27,79Bo01=3 **
*^{138}Cs J : 81Th06=6 **
*^{138}La J : 55So31,72Fi14=5 **
*^{138}Ce T : see also 17Be21t **
*^{138}Pr^m J : 72Ek04=7 **
*^{138}Pm J : expected conf=p5/2[532]n1/2[400],K=3- (deformed shape) **
*^{138}Pm^m I : not confirmed in 00Be42 **
*^{138}Eu^m J : from the expected conf=p5/2[413] n9/2[514],K=2- (deformed shape); **
*^{138}Eu^m J : from systematics (p5/2[413] at Z=63 and n9/2[514] at N=75); **
*^{138}Eu^m J : Ensdf2017=(1-) **
*^{138}Eu^m J : from the expected conf=p5/2[413] n9/2[514],K=7- (deformed shape); **
*^{138}Eu^m J : from systematics (p5/2[413] at Z=63 and n9/2[514] at N=75); **
*^{138}Eu^m J : Ensdf17 J=(6-) as a ground state, but the proposed **
*^{138}Eu^m J : conf=p5/2[532] n7/2[404] violates the GM rule **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{139}Sn	−39310#	400#				120	ms	38	$5/2^-$#	16	20Wu04	T	2015	β^-=100;β^-n ?;β^-2n ?	*
^{139}Sb	−50050#	400#				182	ms	9	$7/2^+$#	16	20Wu04	T	1994	β^-=100;β^-n=90 10;β^-2n ?	*
^{139}Te	−60205	4				724	ms	81	$5/2^-$#	16	20Wu04	TD	1994	β^-=100;β^-n ?	*
^{139}I	−68471	4				2.280	s	0.011	$7/2^+$#	16	17AgZZ	D	1949	β^-=100;β^-n=9.74 24	*
^{139}Xe	−75644.6	2.1				39.68	s	0.14	$3/2^-$*	16			1951	β^-=100	*
^{139}Cs	−80701	3				9.27	m	0.05	$7/2^+$*	16			1939	β^-=100	*
^{139}Ba	−84913.92	0.25				82.93	m	0.09	$7/2^-$*	16			1937	β^-=100	*
^{139}La	−87222.4	0.6				STABLE			$7/2^+$*	16			1924	IS=99.9 1119	*
^{139}La^m	−85422.0	0.7	1800.4	0.4		315	ns	35	$(17/2^+)$				2012	IT=100	
^{139}Ce	−86957.7	2.1				137.642	d	0.020	$3/2^+$*	16	FGK204	T	1948	ε=100	*
^{139}Ce^m	−86203.5	2.1	754.24	0.08		57.58	s	0.32	$11/2^-$	16			1967	IT=100	
^{139}Pr	−84829	4				4.41	h	0.04	$5/2^+$*	16			1951	β^+=100	*
^{139}Nd	−82017	28				29.7	m	0.5	$3/2^+$*	16			1951	β^+=100	*
^{139}Nd^m	−81786	28	231.16	0.05		5.50	h	0.20	$11/2^-$*	16			1951	β^+=87.0 10;IT=13.0 10	
^{139}Nd^n	−79400	28	2616.9	0.6		276.8	ns	1.8	$23/2^+$	16			1980	IT=100	*
^{139}Pm	−77501	14				4.15	m	0.05	$(5/2)^+$	16			1967	β^+=100	
^{139}Pm^m	−77312	14	188.7	0.3		180	ms	20	$(11/2)^-$	16			1975	IT≈100;β^+ ?	
^{139}Sm	−72380	11				2.57	m	0.10	$1/2^+$*	16			1971	β^+=100	*
^{139}Sm^m	−71923	11	457.38	0.23		10.7	s	0.6	$11/2^-$	16			1973	IT=93.7 5;β^+=6.3 5	
^{139}Eu	−65398	13				17.9	s	0.6	$(11/2)^-$	16			1975	β^+=100	
^{139}Eu^m	−65250	13	148.3	0.3		10	μs	2	$(7/2^+)$	16			2011	IT=100	
^{139}Gd	−57630#	200#			*	5.7	s	0.3	$9/2^-$#	16	99Xi04	T	1983	β^+=100;β^+p=?	*
^{139}Gd^m	−57380#	250#	250#	150#	*	4.8	s	0.9	$1/2^+$#	16			1983	β^+=100;β^+p=?	*
^{139}Tb	−48130#	300#				1.6	s	0.2	$5/2^-$#	16			1999	β^+=100;β^+p ?	
^{139}Dy	−37700#	500#				600	ms	200	$(7/2^+)$	01			1999	β^+=100;β^+p≈11	

*^{139}Sn T : average 20Wu04=114(49) 15Lo04=130(60) **
*^{139}Sb T : other 11Ar18=93(+14-3) **
*^{139}Te T : others (not trusted) 11Ar18=1600(300) 06KeZZ=598(20) **
*^{139}I D : %β^-n average 17AgZZ=9.27(0.33) 93Ru01=10.3(0.4) 81Ho07=10.0(1.1) **
*^{139}I D : 75As04=10.2(0.9) **
*^{139}Xe J : also 90NeZY=3/2 **
*^{139}Cs J : 79Bo01,79Ek02,81Th06,87Co19=7/2 **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{139}Ba	J : 83Mu12=7/2												**
*^{139}La	J : 71Ch02=7/2												**
*^{139}Ce	J : 73In04=3/2												**
*^{139}Pr	J : 72Ek04=5/2												**
*^{139}Nd	J : 72Ek04=3/2												**
*^{139}Nd^m	J : 72Ek04=11/2												**
*^{139}Nd^n	T : average 13Va10=278(2) 08Fe02=272(4)												**
*^{139}Sm	J : 92Le09=1/2												**
*^{139}Gd	T : average 99Xi04=5.8(0.9) 88Be.A=5.8(0.4); other 83Ni05=4.9(1.0)												**
*^{139}Gd	T : not used since it corresponds to a mixture of gs and the isomer												**
*^{139}Gd	D : β^+p were observed in 83Ni05 and it is assumed that they are												**
*^{139}Gd	D : associated with both the ground state and the isomer												**
*^{139}Gd^m	D : β^+p were observed in 83Ni05 and it is assumed that they are												**
*^{139}Gd^m	D : associated with both the ground state and the isomer												**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{140}Sn	−34490#	300#				50# ms >550ns	0^+		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{140}Sb	−44390#	600#				170 ms 6	(3^-)	18	20Wu04	T	2010	β^-=100;β^-n=23 4; β^-2n=7.6 25	*
^{140}Sb^m	−44060#	600#	330#	30#		41 μs 8	$(6^-,7^-)$	18	16Lo01	ETJ	2016	IT=100	*
^{140}Te	−56367	14				351 ms 5	0^+	18	20Wu04	TD	1994	β^-=100;β^-n=?	*
^{140}I	−63606	12				588 ms 10	(2^-)	18	17Mo19	J	1972	β^-=100;β^-n=7.60 28; β^-2n ?	*
^{140}Xe	−72986.5	2.3				13.60 s 0.10	0^+	18			1951	β^-=100	
^{140}Cs	−77050	8				63.7 s 0.3	1^-*	18			1950	β^-=100	*
^{140}Cs^m	−77036	8	13.931	0.021		471 ns 51	$(2)^-$	18			1974	IT=100	
^{140}Ba	−83268	8				12.7534 d 0.0021	0^+	18	FGK204	T	1939	β^-=100	
^{140}La	−84312.1	0.6				40.289 h 0.004	3^-*	18	FGK209	T	1935	β^-=100	*
^{140}Ce	−88074.2	1.3				STABLE	0^+	18			1925	IS=88.449 51	
^{140}Ce^m	−85966.3	1.3	2107.854	0.024		7.3 μs 1.5	6^+	18			1966	IT=100	
^{140}Pr	−84686	6				3.39 m 0.01	1^+*	18			1938	β^+=100;e$^+$=48.7 22; ε=51.3 22	*
^{140}Pr^m	−84558	6	127.8	0.3		350 ns 20	5^+	18			1964	IT=100	
^{140}Pr^n	−83922	6	763.7	0.5		3.05 μs 0.20	$(7)^-$	18			1964	IT=100	
^{140}Nd	−84257	3				3.37 d 0.02	0^+	18			1949	ε=100	
^{140}Nd^m	−82035	3	2221.65	0.09		600 μs 50	7^-	18			1962	IT=100	
^{140}Nd^n	−76822	3	7435.1	0.4		1.22 μs 0.06	20^+		08Fe02	TJ	2008	IT=100	*
^{140}Pm	−78212	24				9.2 s 0.2	1^+	18			1966	β^+=100	
^{140}Pm^m	−77783	13	429	28	BD	5.95 m 0.05	8^-	18			1966	β^+=100	
^{140}Sm	−75456	12				14.82 m 0.12	0^+	18			1967	β^+=100	
^{140}Eu	−66990	50				1.51 s 0.02	1^+	18	91Fi03	TD	1982	β^+=100;e$^+$=95.1 7; ε=4.9 7	
^{140}Eu^m	−66780	50	210	14		125 ms 2	(5^-)	18	91Fi03	TDE	1988	IT≈100;β^+<1	*
^{140}Eu^n	−66320	50	669	14		299.8 ns 2.1	(8^+)	18			2002	IT=100	*
^{140}Gd	−61782	28				15.8 s 0.4	0^+	18	91Fi03	TD	1985	β^+=100;e$^+$=67 8;ε=33 8	
^{140}Tb	−50480	800				2.29 s 0.15	(7^+)	18	91Fi03	D	1986	β^+=100;ε<3;β^+p=0.26 13	
^{140}Dy	−42830#	400#				700# ms	0^+	18			2002	β^+ ?;β^+p ?	
^{140}Dy^m	−40660#	400#	2166.1	0.5		7.0 μs 0.5	8^-	18	15Ko14	JE	2002	IT=100	
^{140}Ho	−29320#	500#				6 ms 3	8^+#	18			1999	p=?;β^+ ?;β^+p ?	*

*^{140}Sb	T : average 20Wu04=169(7) 17Mo12=173(12)	**
*^{140}Sb^m	E : 16Lo01=298.2+x keV; x=30#(30#) keV estimated by the authors	**
*^{140}Te	T : average 20Wu04=360(21) 17Mo19=350(5); other 06KeZZ=334(14)	**
*^{140}I	T : average 20Wu04=553(46) 76Lu02=590(10); others 76Ah01=860(40)	**
*^{140}I	T : 75Kr17=870(40) 74Kr21=880(130) 70HeZH=860(140) 70WiZN=880(120)	**
*^{140}I	D : %β^-n from 17AgZZ=7.60(0.28); other (recent)20Wa04=7.6(0.9,sta)(2.7,syst)	**
*^{140}Cs	J : 79Ek02,79Bo01=1	**
*^{140}La	J : 76Fu06=3	**
*^{140}Pr	T : other: 07Li71=7.3(0.4) for q=59+ (bare ion) 3.04(0.10) for q=58+	**
*^{140}Pr	T : (H-like ion) and 3.84(0.15) for q=57+ (He-like ion)	**
*^{140}Pr	D : %e$^+$=42.4(2.3); %ε=57.6(2.3) for q=58+ (H-like ion) and	**
*^{140}Pr	D : %e$^+$=51.2(3.1); %ε=48.8(3.1) for q=57+ (He-like ion)	**
*^{140}Pr	D : e$^+$ decay for the ground state (neutral atom) from 72Ev01	**
*^{140}Nd^n	T : average 13Va10=1.2(0.1) 08Fe02=1.23(0.07)	**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{140}Eu^m	E : from 185.3+x keV and x<50 keV in 91Fi03														**
*^{140}Eu^n	E : from 459.5(0.3) keV above ^{140}Eu^m														**
*^{140}Ho	D : %p observed in 99Ry04														**
^{141}Sb	−39540#	500#				103	ms	29	$7/2^+$#	18	20Wu04	TD	2018	β^-=100;β^-n ?;β^-2n ?	
^{141}Te	−50670#	400#				193	ms	16	$5/2^-$#	14	20Wu04	TD	1994	β^-=100;β^-n ?;β^-2n ?	
^{141}I	−59927	16				420	ms	7	$7/2^+$#	14	20Wu04	TD	1974	β^-=100;β^-n=21.2 30	*
^{141}Xe	−68197.3	2.9				1.73	s	0.01	$5/2^-$*	14	90NeZY	J	1951	β^-=100;β^-n=0.044 5	*
^{141}Cs	−74477	9				24.84	s	0.16	$7/2^+$*	14	93Ru01	TD	1962	β^-=100;β^-n=0.0342 14	*
^{141}Ba	−79732	5				18.27	m	0.07	$3/2^-$*	14			1945	β^-=100	
^{141}La	−82930	4				3.92	h	0.03	$(7/2^+)$	14			1951	β^-=100	
^{141}Ce	−85431.1	1.3				32.505	d	0.010	$7/2^-$*	14	FGK204	T	1948	β^-=100	
^{141}Pr	−86014.5	1.5				STABLE			$5/2^+$*	14			1924	IS=100	
^{141}Nd	−84192	3				2.49	h	0.03	$3/2^+$*	14			1949	β^+=100;ε=97.28 16; e$^+$=2.72 16	*
^{141}Nd^m	−83435	3	756.51	0.05		62.0	s	0.8	$11/2^-$	14	70Ab05	D	1960	IT≈100;β^+=0.032 8	
^{141}Pm	−80523	14				20.90	m	0.05	$5/2^+$*	14			1952	β^+=100	
^{141}Pm^m	−79894	14	628.62	0.07		630	ns	20	$11/2^-$	14			1970	IT=100	
^{141}Pm^n	−77992	14	2530.75	0.17		> 2	µs		$(23/2^+)$	14	85Ar19	TDJ	1985	IT=100	
^{141}Sm	−75934	9				10.2	m	0.2	$1/2^+$*	14			1967	β^+=100	
^{141}Sm^m	−75758	9	175.9	0.3		22.6	m	0.2	$11/2^-$*	14			1967	β^+=99.69 3;IT=0.31 3	
^{141}Eu	−69926	13				40.7	s	0.7	$5/2^+$	14			1977	β^+=100	
^{141}Eu^m	−69830	13	96.45	0.07		2.7	s	0.3	$11/2^-$	14			1973	IT=86 3;β^+=14 3	*
^{141}Gd	−63224	20				14	s	4	$(1/2^+)$	14			1986	β^+=100;β^+p=0.03 1	*
^{141}Gd^m	−62846	20	377.76	0.09		24.5	s	0.5	$(11/2^-)$	14			1986	β^+=89 2;IT=11 2	*
^{141}Tb	−54540	110			*	3.5	s	0.2	$(5/2^-)$	14			1986	β^+=100	
^{141}Tb^m	−54540#	230#	0#	200#	EU*	7.9	s	0.6	$11/2^-$#	14	88Be.A	I	1988	β^+=100	
^{141}Dy	−45380#	300#				900	ms	140	$(9/2^-)$	14			1984	β^+=100;β^+p=?	
^{141}Ho	−34360#	400#				4.1	ms	0.1	$(7/2^-)$	14			1998	p≈100;β^+ ?;β^+p ?	
^{141}Ho^m	−34290#	400#	66	2		7.3	µs	0.3	$(1/2^+)$	14			1998	p=100	
*^{141}I	D : %β^-n from 80Al15														**
*^{141}I	T : average 20Wu04=418(8) 80Al15=430(20); others 74Kr21=410(80)														**
*^{141}I	T : 76Lu02=480(30) 70HeZX=430(80)														**
*^{141}Xe	J : also 90NeZY=5/2														**
*^{141}Cs	T : average 93Ru01=24.34(0.12) 86Ok03=24.98(0.13) 76Ot03=24.94(0.06),														**
*^{141}Cs	T : Birge ratio=3.26														**
*^{141}Nd	D : %e$^+$ average 72Ev01=2.72(0.20) 66Gr05=2.73(0.27)														**
*^{141}Eu^m	D : symmetrized from %IT=87(+2-4) and %β^+=13(+4-2)														**
*^{141}Gd	J : weak J$^\pi$ arguments in Ensdf2001														**
*^{141}Gd^m	J : weak J$^\pi$ arguments in Ensdf2001														**
^{142}Sb	−33610#	300#				80	ms	50			20Wu04	T	2018	β^-=100;β^-n ?;β^-2n ?	*
^{142}Te	−46550#	500#				147	ms	8	0^+	11	20Wu04	TD	1994	β^-=100;β^-n ?;β^-2n ?	
^{142}I	−54803	5				235	ms	11	2^-#	11	20Wu04	TD	1975	β^-=100;β^-n ?;β^-2n ?	*
^{142}Xe	−65229.6	2.7				1.23	s	0.02	0^+	11			1960	β^-=100;β^-n=0.37 3	*
^{142}Cs	−70515	7				1.687	s	0.010	0^-*	11	93Ru01	TD	1962	β^-=100;β^-n=0.089 3	*
^{142}Ba	−77842	6				10.6	m	0.2	0^+	11			1959	β^-=100	
^{142}La	−80024	6				91.1	m	0.5	2^-	11	19Kr10	T	1953	β^-=100	*
^{142}La^m	−79878	6	145.82	0.08		870	ns	170	$(4)^-$	11			1983	IT=100	
^{142}Ce	−84532.9	2.4				STABLE		>2.9Ey	0^+	11	19Be29	T	1925	IS=11.114 51;α ?;2β^- ?	*
^{142}Pr	−83786.4	1.5				19.12	h	0.04	2^-*	11			1935	β^-≈100;ε=0.0164 8	
^{142}Pr^m	−83782.7	1.5	3.694	0.003		14.6	m	0.5	5^-*	11			1967	IT=100	
^{142}Nd	−85950.1	1.3				STABLE			0^+	11			1924	IS=27.153 40	
^{142}Nd^m			*non − exist*		EU	16.5	µs		6^+	14	87Pr09	I	1964	IT=100	*
^{142}Pm	−81142	24				40.5	s	0.5	1^+	11	91Fi03	TD	1959	β^+=100;e$^+$=77.1 27; ε=22.9 27	*
^{142}Pm^m	−80259	24	883.17	0.16		2.0	ms	0.2	$(8)^-$	11			1971	IT=100	
^{142}Pm^n	−78313	24	2828.7	0.6		67	µs	5	(13^-)	11			1974	IT=100	
^{142}Sm	−78981.9	1.9				72.49	m	0.05	0^+	11	91Fi03	TD	1959	β^+=100;e$^+$<5	
^{142}Sm^m	−76609.8	1.9	2372.1	0.4		170	ns	2	7^-	11			1975	IT=100	
^{142}Sm^n	−75319.7	2.0	3662.2	0.7		480	ns	60	10^+	11			1979	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{142}Eu	−71310	30				2.36	s	0.10	1^+	11	91Fi03	TD	1966	β^+=100;e$^+$=89.9 16; ε=10.1 16	*
^{142}Eu^m	−70856	12	450	30	BD	1.223	m	0.008	8^-	11			1966	β^+=100	
^{142}Gd	−66960	28				70.2	s	0.6	0^+	11			1986	β^+=100;ε=52 5;e$^+$=48 5	
^{142}Tb	−56560	700				597	ms	17	1^+	11	91Fi03	TD	1991	β^+=100;e$^+$=96.8 4; ε=3.2 4;β^+p=0.0022 11	
^{142}Tb^m	−56280	700	279.7	0.4		303	ms	17	5^-	11			1986	IT=100	
^{142}Tb^n	−55910	700	652.1	0.6		26	μs	1	8^+	11			1989	IT=100	
^{142}Dy	−50120#	730#				2.3	s	0.3	0^+	11	91Fi03	TD	1986	β^+=100;e$^+$=90 4;ε=10 4; β^+p=0.06 3	
^{142}Ho	−37250#	400#				400	ms	100	$(7^-,8^+)$	11			2001	$\beta^+\approx$100;β^+p=?;p$\approx$0	*
^{142}Er	−27930#	500#				10#	μs		0^+					p ?	

*^{142}Sb T : symmetrized from 20Wu04=53(+69-31) **
*^{142}I T : other 06KeZZ=222(12) **
*^{142}Xe D : %β^-n average 03Be05=0.21(0.06) 75As04=0.406(0.034) 69Ta04=0.45(0.08) **
*^{142}Cs T : average 03Be05=1.65(0.04) 93Ru01=1.684(0.014) 81En05=1.75(0.06) **
*^{142}Cs T : 77Re05=1.70(0.02) 69Ca03=1.68(0.02) **
*^{142}Cs D : %β^-n average 93Ru01=0.0896(0.0036) 81En05=0.082(0.008) **
*^{142}Cs D : 80ReZQ=0.090(0.005) **
*^{142}La T : other (recent) 19Kr10=91.8(1.2) **
*^{142}Ce T : lower limit is for α decay; 2ν-$\beta\beta$ 11Be02>300Py 01Da22>260 Py **
*^{142}Nd^m I : originally reported in 64Kr02, but not confirmed in the pulsed-beam **
*^{142}Nd^m I : data of 87Pr09 **
*^{142}Pm T : other: 09Wi09=56(3) for q=61+ (bare ion) 39.2(0.7) for q=60+ **
*^{142}Pm T : (H-like ion) 39.6(1.4) for q=59+ (He-like ion) **
*^{142}Pm T : 19Oz03=55(3) for q=60+ (H-like ion) **
*^{142}Pm D : %e$^+$=71.0(1.3); %ε=29.0(1.3) for q=60+ (H-like ion) and **
*^{142}Pm D : %e$^+$=79.8(1.0); %ε=20.2(1.0) for q=59+ (He-like ion) **
*^{142}Eu T : average 91Fi03=2.34(0.12) 75Ke08=2.4(0.2) **
*^{142}Ho D : %p 93Li40=0 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{143}Te	−40530#	500#				120	ms	8	$7/2^+$#	12	20Wu04	TD	2010	β^-=100;β^-n ?;β^-2n ?	
^{143}I	−50790#	200#				182	ms	8	$7/2^+$#	12	20Wu04	TD	1994	β^-=100;β^-n ?;β^-2n ?	*
^{143}Xe	−60203	5				511	ms	6	$5/2^-$*	12	03Be05	D	1951	β^-=100;β^-n=1.00 15	
^{143}Cs	−67676	8				1.802	s	0.008	$3/2^+$*	12	93Ru01	TD	1962	β^-=100;β^-n=1.62 6	*
^{143}Ba	−73937	7				14.5	s	0.3	$5/2^-$*	12			1962	β^-=100	
^{143}La	−78171	7				14.2	m	0.1	$(7/2)^+$	12			1951	β^-=100	
^{143}Ce	−81606.4	2.4				33.039	h	0.006	$3/2^-$*	12			1948	β^-=100	
^{143}Pr	−83068.2	1.8				13.57	d	0.02	$7/2^+$*	12			1948	β^-=100	
^{143}Nd	−84002.3	1.3				STABLE		>3.1Ey	$7/2^-$*	12	17Wi01	T	1933	IS=12.173 26	
^{143}Pm	−82960.7	2.9				265	d	7	$5/2^+$	12			1952	ε=100;e$^+$<5.7e-6	
^{143}Sm	−79517.1	2.7				8.75	m	0.06	$3/2^+$*	12			1956	β^+=100;e$^+$=40.0 20; ε=60.0 20	*
^{143}Sm^m	−78763.1	2.7	753.99	0.16		66	s	2	$11/2^-$	12			1960	IT$\approx$100;β^+=0.24 5	
^{143}Sm^n	−76723.3	3.0	2793.8	1.3		30	ms	3	$23/2^-$	12	FGK128	J	1969	IT=100	*
^{143}Eu	−74241	11				2.59	m	0.02	$5/2^+$*	12			1965	β^+=100	
^{143}Eu^m	−73851	11	389.51	0.04		50.0	μs	0.5	$11/2^-$	12			1978	IT=100	
^{143}Gd	−68230	200				39	s	2	$1/2^+$	12	78Fi02	D	1975	β^+=100;β^+p=?;$\beta^+\alpha$=?	*
^{143}Gd^m	−68080	200	152.6	0.5		110.0	s	1.4	$11/2^-$	12	78Fi02	D	1973	β^+=100;β^+p=?;$\beta^+\alpha$=?	*
^{143}Tb	−60420	50			*	12	s	1	$(11/2^-)$	12			1985	β^+=100	
^{143}Tb^m	−60420#	110#	0#	100#	*	17	s	4	$5/2^+$#	12	86Re11	T	1986	β^+ ?	
^{143}Dy	−52169	13				5.6	s	1.0	$(1/2^+)$	12	03Xu04	J	1983	β^+=100;β^+p=?	*
^{143}Dy^m	−51858	13	310.7	0.6		3.0	s	0.3	$(11/2^-)$	12	03Xu04	EJD	2003	β^+=100;β^+p=?	
^{143}Dy^n	−51763	13	406.3	0.8		1.2	μs	0.3	$(7/2^-)$	12	05Ri17	DEJ	2005	IT=100	*
^{143}Ho	−42050#	300#				300#	ms	>200ns	$11/2^-$#	12	00So11	I	2000	β^+ ?;β^+p ?	
^{143}Er	−31160#	400#				200#	ms		$9/2^-$#	12			2005	β^+ ?;β^+p ?	

*^{143}I T : other 06KeZZ=130(45) **
*^{143}Cs T : average 03Be05=1.77(0.03) 93Ru01=1.809(0.009) 81En05=1.83(0.04) **
*^{143}Cs T : 79Ri09=1.765(0.030) 77Re05=1.79(0.02) **
*^{143}Sm D : %e$^+$ from 72Ev01 **
*^{143}Sm^n J : E3 to 17/2+ **
*^{143}Gd D : %β^+p and %$\beta^+\alpha$ from 78Fi02 for ^{143}Gd,^{143}Gd^m=0.001; **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{143}Gd D : 39 particles detected **
*^{143}Gd^m J : from 05Ba64 **
*^{143}Dy T : 03Xu04=5.6(1.0); 84Ni03=3.2(0.6) 83Ni05=4.1(0.3) in diff. experiments **
*^{143}Dy^n E : 95.6(0.5) keV above ^{143}Dy^m **
*^{143}Dy^n J : from depopulating 95.6-keV gamma being most likely E2 in 05Ri17 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{144}Te	−36220#	300#				93	ms	60	0^+	18	20Wu04	TD	2015	β^-=100;β^-n ?;β^-2n ?	
^{144}I	−45330#	400#				94	ms	8	1^-#	01	20Wu04	TD	1994	β^-=100;β^-n ?;β^-2n ?	
^{144}Xe	−56872	5				388	ms	7	0^+	01	03Be05	TD	2003	β^-=100;β^-n=3.0 3	
^{144}Cs	−63271	20				994	ms	6	1^-*	10	20Cz01	D	1967	β^-=100;β^-n=2.98 6	*
^{144}Cs^m	−63179	20	92.2	0.5		1.1	μs	0.1	(4^-)	10			2009	IT=100	
^{144}Cs^n			*non − exist*		EU	< 1	s		$(>3^-)$	10	78MoZQ	IJT	1978	β^-=?;IT ?;β^-n ?	*
^{144}Ba	−71767	7				11.73	s	0.08	0^+	01	19KoZX	T	1967	β^-=100	*
^{144}La	−74850	13				44.0	s	0.7	(3^-)	01	FGK205	T	1967	β^-=100	*
^{144}Ce	−80431.9	2.8				284.886	d	0.025	0^+	01	FGK209	T	1945	β^-=100	
^{144}Pr	−80750.6	2.7				17.28	m	0.05	0^-	01			1951	β^-=100	
^{144}Pr^m	−80691.6	2.7	59.03	0.03		7.2	m	0.3	3^-	01			1970	IT≈100;β^-≈0.07	
^{144}Nd	−83748.0	1.3				2.29	Py	0.16	0^+	01			1924	IS=23.798 19;α=100	
^{144}Pm	−81416.1	2.9				363	d	14	5^-	01	94Hi05	D	1952	ε=100;e$^+$<8e-5	
^{144}Pm^m	−80575.2	2.9	840.90	0.05		780	ns	200	$(9)^+$	01			1993	IT=100	
^{144}Pm^n	−72820	4	8595.8	2.2		∼ 2.7	μs		(27^+)	01			1994	IT=100	
^{144}Sm	−81965.6	1.5				STABLE			0^+	01			1933	IS=3.08 4;2β^+ ?	*
^{144}Sm^m	−79642.0	1.5	2323.60	0.08		880	ns	25	6^+	01			1972	IT=100	
^{144}Eu	−75619	11				10.2	s	0.1	1^+	01			1965	β^+=100	
^{144}Eu^m	−74491	11	1127.6	0.6		1.0	μs	0.1	8^-	01	FGK127	J	1976	IT=100	*
^{144}Gd	−71760	28				4.47	m	0.06	0^+	01			1968	β^+=100	
^{144}Gd^m	−68327	28	3433.1	0.5		145	ns	30	(10^+)	01			1978	IT=100	
^{144}Tb	−62368	28				∼ 1	s		1^+	01			1982	β^+=100	
^{144}Tb^m	−61971	28	396.9	0.5		4.25	s	0.15	6^-	01			1982	IT=66;β^+=34	*
^{144}Tb^n	−61892	28	476.2	0.5		2.8	μs	0.3	(8^-)	01			1996	IT=100	
^{144}Tb^p	−61851	28	517.1	0.5		670	ns	60	(9^+)	01			1996	IT=100	
^{144}Tb^q	−61824	28	544.5	0.6		< 300	ns		(10^+)	01			1996	IT=100	
^{144}Dy	−56570	7				9.1	s	0.4	0^+	01			1986	β^+=100;β^+p=?	
^{144}Ho	−44610	8				700	ms	100	(5^-)	08			1986	β^+=100;β^+p=?	
^{144}Ho^m	−44345	8	265.3	0.3		519	ns	5	(8^+)	08	10Ma08	T	2001	IT=100	
^{144}Er	−36610#	200#				400#	ms	>200ns	0^+	06			2003	β^+ ?	
^{144}Tm	−22160#	400#				2.3	μs	0.9	(10^+)	08			2005	p=?;β^+ ?	*

*^{144}Cs D : %β^-n average 20Cz01=2.95(0.24) 93Ru01=3.17(0.13) 79Ri09=2.95(0.25) **
*^{144}Cs D : 80ReZQ=3.12(0.11), 2.67(0.12) **
*^{144}Cs T : other (recent) 17Wu04=932(76) **
*^{144}Cs^n I : introduced in 78MoZQ, but no β^- decaying isomer was observed in later **
*^{144}Cs^n I : studies; most likely this is ^{144}Cs^m **
*^{144}Ba T : average 19KoZX=11.6(0.1) 82Ch22=11.5(0.2) 79En02=12.0(0.4) **
*^{144}Ba T : 76AmZW=11.9(0.6) 78Wo09=12.3(0.4) 74Gr29=11.1(0.5) **
*^{144}Ba T : 69WiZX=12.3(0.2) 69Ru14=11.9(0.3) **
*^{144}La T : other Ensdf2001=40.8(0.4) is likely affected by ^{144}Ba impurities **
*^{144}Sm T : 0nu-BB 18No01>1 Py **
*^{144}Eu^m J : E2 to 6- **
*^{144}Tb^m T : other 03Li42=12(2) s for q=65+ (bare ion) **
*^{144}Tb^m J : E3 to 3+ **
*^{144}Tm T : symmetrized from 05Gr32,05Bi24=1.9(+1.2-0.5) us **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{145}Te	−30010#	300#				75#	ms	>550ns	0^+	18	18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{145}I	−41130#	500#				89.7	ms	9.3	$7/2^+$#	10	20Wu04	TD	2010	β^-=100;β^-n ?;β^-2n ?	
^{145}Xe	−51493	11				188	ms	4	$3/2^-$#	09			2003	β^-=100;β^-n=5.0 6;β^-2n ?	
^{145}Cs	−60054	9				582	ms	4	$3/2^+$*	09	20Cz01	D	1971	β^-=100;β^-n=12.8 3	*
^{145}Cs^m	−59291	9	762.9	0.4		500	ns	100	13/2#		15YaZW	TD	2015	IT=100	*
^{145}Ba	−67516	8				4.31	s	0.16	$5/2^-$*	09			1974	β^-=100	
^{145}La	−72835	12				24.8	s	2.0	$(5/2^+)$	09			1974	β^-=100	
^{145}Ce	−77070	30				3.01	m	0.06	$5/2^-$#	09			1954	β^-=100	
^{145}Pr	−79626	7				5.984	h	0.010	$7/2^+$	09			1954	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{145}Nd	−81432.0	1.3				STABLE		>60Py	$7/2^-$∗	09	65Is01	T	1933	IS=8.293 12;α ?	
^{145}Pm	−81267.5	2.8				17.7	y	0.4	$5/2^+$	09			1951	ε=100;α=2.8e-7	
^{145}Sm	−80651.4	1.5				340	d	3	$7/2^-$	09			1947	ε=100	
^{145}Sm^m	−71836.4	1.8	8815	1		3.52	μs	0.16	$49/2^+$	09	20Ge08	EJT	1993	IT=100	∗
^{145}Eu	−77992	3				5.93	d	0.04	$5/2^+$∗	09			1951	β^+=100	
^{145}Eu^m	−77276	3	716.0	0.3		490	ns	30	$11/2^-$	09			1975	IT=100	
^{145}Gd	−72927	20				23.0	m	0.4	$1/2^+$∗	09			1959	β^+=100	
^{145}Gd^m	−72178	20	749.1	0.2		85	s	3	$11/2^-$	09			1969	IT=94.3 5;β^+=5.7 5	
^{145}Tb	−66400	110			*&	30.9	s	0.6	$(11/2^-)$	09			1981	β^+=100	
^{145}Tb^m	−65540	200	860	230	BD*&				$(3/2^+)$	09			1993	β^+ ?	
^{145}Dy	−58243	7				9.5	s	1.0	$(1/2^+)$	09	93Al03	T	1982	β^+=100;β^+p=?	∗
^{145}Dy^m	−58125	7	118.2	0.2		14.1	s	0.7	$(11/2^-)$	09			1982	β^+=100;β^+p≈50	
^{145}Ho	−49120	7			*	2.4	s	0.1	$(11/2^-)$	09			1987	β^+=100	
^{145}Ho^m	−49020#	100#	100#	100#	*	100#	ms		$5/2^+$#					β^+ ?;IT ?	
^{145}Er	−39240#	200#				900	ms	200	$(1/2^+)$	09	10Ma20	T	1989	β^+=100;β^+p=?	∗
^{145}Er^m	−39040#	200#	205	4	p	1.0	s	0.3	$(11/2^-)$		10Ma20	T	2010	β^+=100;IT ?;β^+p=?	
^{145}Tm	−27580#	200#				3.17	μs	0.20	$(11/2^-)$	09			1998	p=100	

∗^{145}Cs T : average 20Wu04=612(20) 17Wu04t=613(+32-24) 03Be05=558(9) 93Ru01=579(6) ∗∗

∗^{145}Cs T : 82Ra13=594(13) 81En05=610(30) 79Ri09=616(20) 79En02=605(30) ∗∗

∗^{145}Cs T : 78Wo09=590(20) 77Re05=580(14) 74Ro15=611(21) 71Tr02=563(27) ∗∗

∗^{145}Cs D : %β^-n average 20Cz01=13.53(0.90) 93Ru01=14.4(0.6) 80ReZQ=13.3(1.4) ∗∗

∗^{145}Cs D : 79Ri09=12.2(0.9) 78Cr03=12.5(3.0) 74Ro15=12.1(0.4) ∗∗

∗^{145}Cs^m E : 16Ya.A=762.9(0.4) keV ∗∗

∗^{145}Sm^m T : other 93Fe14=0.96(+0.19-0.15) ∗∗

∗^{145}Dy T : average 93Al03=10.5(1.5) 93To04=6(2) 84Sc.C=10(1) ∗∗

∗^{145}Er T : 10Ma20=900(200) 89Vi02=900(300) for a mixture between gs and the isomer ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{146}I	−35540#	300#				94	ms	26			20Wu04	TD	2018	β^-=100;β^-n ?;β^-2n ?	
^{146}Xe	−47955	24				146	ms	6	0^+	16	20Wu04	TD	1989	β^-=100;β^-n=6.9 15	∗
^{146}Cs	−55310.4	2.9				321.6	ms	0.9	1^-∗	16	93Ru01	TD	1971	β^-=100;β^-n=14.2 4;β^-2n ?	∗
^{146}Cs^m	−55263.7	2.9	46.7	0.1		1.25	μs	0.05	4^-#	16	15YaZW	TD	2015	IT=100	∗
^{146}Ba	−64866.3	1.8				2.15	s	0.04	0^+	16	19KoZX	T	1970	β^-=100	∗
^{146}La	−69221.2	1.7			*&	9.9	s	0.1	(5^-)	16			1970	β^-=100	∗
^{146}La^m	−69079.7	1.7	141.5	2.4	MD*&	6.08	s	0.22	$(1^-,2^-)$	16	20Or02	E	1969	β^-=100	∗
^{146}Ce	−75626	15				13.49	m	0.16	0^+	16			1953	β^-=100	
^{146}Pr	−76670	30				24.09	m	0.10	(2^-)	16			1953	β^-=100	
^{146}Nd	−80925.9	1.3				STABLE		>1.6Ey	0^+	16	15St09	T	1924	IS=17.189 32;2β^- ?;α ?	∗
^{146}Pm	−79454	4				5.53	y	0.05	3^-	16			1960	ε=66.0 13;β^-=34.0 13	
^{146}Sm	−80996	3				68	My	7	0^+	16			1953	α=100	∗
^{146}Eu	−77118	6				4.61	d	0.03	4^-∗	16			1957	β^+=100	
^{146}Eu^m	−76452	6	666.33	0.11		235	μs	3	9^+	16			1962	IT=100	
^{146}Gd	−76086	4				48.27	d	0.09	0^+	16			1957	ε=100	
^{146}Tb	−67760	40			*	8	s	4	1^+	16			1974	β^+=100	
^{146}Tb^m	−67610#	110#	150#	100#	*	24.1	s	0.5	5^-	16	93Al03	T	1974	β^+=100	
^{146}Tb^n	−66830#	110#	930#	100#		1.18	ms	0.02	10^+	16			1989	IT=100	∗
^{146}Dy	−62555	7				33.2	s	0.7	0^+	16	93Al03	T	1981	β^+=100	
^{146}Dy^m	−59621	7	2934.5	0.4		150	ms	20	10^+	16			1982	IT=100	
^{146}Ho	−51238	7				3.32	s	0.22	(6^-)	16			1982	β^+=100;β^+p=?	
^{146}Er	−44322	7				1.7	s	0.6	0^+	16			1993	β^+=100;β^+p=?	
^{146}Tm	−31060#	200#				155	ms	20	(1^+)		05Ro40	TJD	1993	p≈100;β^+ ?;β^+p ?	∗
^{146}Tm^m	−30750#	200#	304	6	p	73	ms	7	(5^-)	16	06Ta08	TJ	1993	p=100;β^+ ?;β^+p ?	∗
^{146}Tm^n	−30620#	200#	437	7	p	200	ms	3	(10^+)	16	06Ta08	TJ	1993	p=?;β^+ ?;β^+p ?	∗

∗^{146}Xe T : average 20Wu04=147(13) 03Be05=146(6) ∗∗

∗^{146}Cs T : average 20Wu04=318(16) 17Wu04=288(13) 03Be05=300(20) 93Ru01=321(2) ∗∗

∗^{146}Cs T : 83Re10=322(1) 79Ri09=325(10) ∗∗

∗^{146}Cs D : %β^-n average 93Ru01=15.1(0.6) 81En05=13.1(1.3) 79Ri09=13.2(0.8) ∗∗

∗^{146}Cs D : 74Ro15=14.2(1.7) ∗∗

∗^{146}Cs^m E : from 16Ya.A=46.7(0.1) ∗∗

∗^{146}Ba D : %β^-n 93Ru01<0.02% not relevant, since Q(β^-n) is negative ∗∗

∗^{146}Ba T : average 19KoZX=2.06(0.07) 85Ch16=2.22(0.07) 78Wo09=2.18(0.11) ∗∗

∗^{146}Ba T : 76AmZW=2.14(0.37) 79En02=2.2(0.3). other: 17Wu04=2.56(0.29) ∗∗

∗^{146}La D : %β^-n 93Ru01<0.007% not relevant, since Q(β^-n) is negative ∗∗

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

$*^{146}$La T : average FGK205=9.9(0.1) 78MoYW=10.0(0.4) 74Ar17=11(1) 79En02=9.0(0.6) **
$*^{146}$La J : region of deformation p5/2[413] n5/2[523],K=5-; **
$*^{146}$La J : Ensdf2016=(6-) based on shell model **
$*^{146}$La^m T : average FGK205=6.1(0.3) 78MoYW=6.2(0.6) 81GoZN=6.0(0.4) **
$*^{146}$La^m J : region of deformation p5/2[413] n1/2[530] or n5/2[523], K=1- or 2-; **
$*^{146}$La^m J : Ensdf2016=(2-) based on shell model **
$*^{146}$Nd T : partial α half-life 15St09>1.6 Ey; other 0nu-BB 18No01>45 Ey **
$*^{146}$Sm T : from 12Ki16t=68(7); others 87Me08=103.1(4.5) 66Fr11=102.6(4.8) **
$*^{146}$Tb^n E : 779.57 keV above ^{146}Tb^m from Ensdf2016 **
$*^{146}$Tm T : other 05Bb02=190(80) ms **
$*^{146}$Tm^m T : average 06Ta08=68(3), supersedes 05Bb02=75(3), 05Ro40=82(4); **
$*^{146}$Tm^m T : Birge ratio=2.8 **
$*^{146}$Tm^n T : average 07DaZU=213(9) 06Ta08=198(3) **

^{147}I	−31200#	300#				60#	ms	>550ns	3/2$^-$#		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{147}Xe	−42400#	200#				88	ms	14	3/2$^-$#	09	20Wu04	T	1994	β^-=100;β^-n<8;β^-2n ?	*
^{147}Cs	−51920	8				230.5	ms	0.9	(3/2$^+$)	09	93Ru01	TD	1978	β^-=100;β^-n=28.5 15	*
^{147}Cs^m	−51219	8	701.4	0.4		190	ns	20	13/2#		15YaZW	TD	2015	IT=100	*
^{147}Ba	−60264	20				893	ms	1	5/2$^-$	09	13Rz01	J	1978	β^-=100;β^-n=0.07 5	*
^{147}La	−66678	11				4.026	s	0.020	(5/2$^+$)	09	96Ur02	J	1979	β^-=100;β^-n=0.041 3	*
^{147}Ce	−72014	9				56.4	s	1.0	(5/2$^-$)	09			1964	β^-=100	
^{147}Pr	−75444	16				13.39	m	0.04	3/2$^+$	09	15Ru09	T	1964	β^-=100	*
^{147}Nd	−78146.8	1.3				10.98	d	0.01	5/2$^-$*	09			1947	β^-=100	
^{147}Pm	−79042.0	1.3				2.6234	y	0.0002	7/2$^+$*	09			1947	β^-=100	
^{147}Sm	−79266.0	1.3				106.6	Gy	0.5	7/2$^-$*	09	FGK204	T	1933	IS=15.00 14;α=100	
^{147}Eu	−77544.6	2.6				24.1	d	0.6	5/2$^+$*	09			1951	$\beta^+\approx$100;α=0.0022 6	
^{147}Eu^m	−76919.3	2.6	625.27	0.05		765	ns	15	11/2$^-$	09			1970	IT=100	
^{147}Gd	−75356.9	1.9				38.06	h	0.12	7/2$^-$*	09			1957	β^+=100	
^{147}Gd^m	−66769.1	2.0	8587.8	0.5		510	ns	20	49/2$^+$	09	20Br06	J	1982	IT=100	
^{147}Tb	−70743	8				1.64	h	0.03	(1/2$^+$)	09			1969	β^+=100	
^{147}Tb^m	−70692	8	50.6	0.9		1.87	m	0.05	(11/2$^-$)	09	93Al03	T	1987	β^+=100	*
^{147}Dy	−64196	9				67	s	7	(1/2$^+$)	09			1975	β^+=100;β^+p$\approx$0.05	
^{147}Dy^m	−63446	9	750.5	0.4		55.2	s	0.5	(11/2$^-$)	09			1976	β^+=68.9 23;IT=31.1 23	
^{147}Dy^n	−60789	9	3407.2	0.8		400	ns	10	(27/2$^-$)	09			1985	IT=100	
^{147}Ho	−55757	5				5.8	s	0.4	(11/2$^-$)	09			1982	β^+=100	
^{147}Ho^m	−53070	5	2687.1	0.4		315	ns	30	(27/2$^-$)	09			1982	IT=100	
^{147}Er	−46610	40			*	3.2	s	1.2	(1/2$^+$)	09	10Ma27	T	1992	β^+=100;β^+p=?	
^{147}Er^m	−46510#	60#	100#	50#	*	1.6	s	0.2	(11/2$^-$)	09	10Ma27	T	1982	β^+=100;β^+p=?	
^{147}Tm	−35974	7				580	ms	30	11/2$^-$	09			1982	β^+=85 5;p=15 5	
^{147}Tm^m	−35913	7	62	5	p	360	μs	40	3/2$^+$	09			1984	p=100	

$*^{147}$Xe T : other 03Be05=100(+100-50) **
$*^{147}$Cs T : average 20Wu04=255(5) 17Wu04=234(14) 93Ru01=235(3) 86ReZU=229(1) **
$*^{147}$Cs T : 79Ri09=214(30) 78Ko29=235(10) **
$*^{147}$Cs D : %β^-n average 93Ru01=30.7(2.0) 86ReZU=26.4(2.9) 79Ri09=25.4(3.2) **
$*^{147}$Cs^m E : from 16Ya.A=701.4(0.4) **
$*^{147}$Ba T : average 17Wu04=921(47) 93Ru01=894(10) 86Wa17=893(1), supersedes 86ReZU **
$*^{147}$Ba D : %β^-n unweighted average 93Ru01=0.110(0.016) 86Wa17=0.019(1); **
$*^{147}$Ba D : Birge ratio=5.68; other 81En05=5.21(52), outlier **
$*^{147}$La T : average 93Ru01=4.100(0.021) 86Wa17=4.015(0.008) 81En05=4.10(0.25); **
$*^{147}$La T : Birge ratio=2.68 **
$*^{147}$La D : %β^-n average 93Ru01=0.043(0.004) 86Wa17=0.035(0.006) **
$*^{147}$Pr J : from 15Wa28 **
$*^{147}$Tb^m T : average 93Al03=1.92(0.07) 73Bo13=1.83(0.06) **

^{148}Xe	−38650#	300#				85	ms	15	0$^+$	14	20Wu04	TD	2010	β^-=100;β^-n ?;β^-2n ?	
^{148}Cs	−46911	13				151.8	ms	1.0	(2$^-$)	14	20Wu04	T	1978	β^-=100;β^-n=28.7 21; β^-2n ?	*
^{148}Cs^m	−46866	13	45.2	0.1		4.8	μs	0.2	4$^-$#		15YaZW	TD	2015	IT=100	*
^{148}Ba	−57544.9	1.5				620	ms	5	0$^+$	14	17Wu04	T	1979	β^-=100;β^-n=0.4 3	*
^{148}La	−62709	19				1.414	s	0.025	(2$^-$)	14	17Wu04	T	1969	β^-=100;β^-n=0.18 7	*
^{148}Ce	−70398	11				56.8	s	0.3	0$^+$	14			1964	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{148}Pr	−72535	15			2.29 m 0.02	1^-	14			1964	β^-=100	
^{148}Pr^m	−72458	15	76.80	0.20	2.01 m 0.07	(4)	14			1964	β^-=64 10;IT=36 10	
^{148}Nd	−77408.1	2.1			STABLE >3.0Ey	0^+	14	82Be20	T	1937	IS=5.756 21;2β^- ?;α ?	*
^{148}Pm	−76866	6			5.368 d 0.007	1^-*	14			1947	β^-=100	
^{148}Pm^m	−76728	6	137.9	0.3	41.29 d 0.11	$5^-,6^-$	14			1951	β^-=95.8 6;IT=4.2 6	
^{148}Sm	−79336.1	1.2			6.3 Py 1.3	0^+	14	16Ca43	T	1933	IS=11.25 9;α=100	*
^{148}Eu	−76297	10			54.5 d 0.5	5^-*	14			1951	β^+=100;α=9.4e-7 28	
^{148}Eu^m	−75577	10	720.4	0.3	162 ns 8	9^+	14			1980	IT=100	
^{148}Gd	−76269.4	1.5			71.3 y 1.0	0^+	14	03Fu10	T	1953	α=100;2β^+ ?	*
^{148}Tb	−70537	12			60 m 1	2^-	14			1960	β^+=100	
^{148}Tb^m	−70447	12	90.1	0.3	2.20 m 0.05	$(9)^+$	14			1973	β^+=100	
^{148}Tb^n	−61918	12	8618.6	1.0	1.310 μs 0.007	(27^+)	14			1980	IT=100	
^{148}Dy	−67859	9			3.3 m 0.2	0^+	14			1974	β^+=100	
^{148}Dy^m	−64940	9	2919.1	1.0	471 ns 20	10^+	14			1978	IT=100	
^{148}Ho	−57990	80			2.2 s 1.1	(1^+)	14			1979	β^+=100	
^{148}Ho^m	−57740#	130#	250#	100#	9.49 s 0.12	(5^-)	14	93Al03	T	1979	β^+=100;β^+p=0.08 1	*
^{148}Ho^n	−57050#	130#	940#	100#	2.36 ms 0.06	$(10)^+$	14			1984	IT=100[gs=0,m=100]	*
^{148}Er	−51479	10			4.6 s 0.2	0^+	14			1982	β^+=100;β^+p≈0.15	
^{148}Er^m	−48566	10	2913.2	0.4	13 μs 3	(10^+)	14			1982	IT=100	
^{148}Tm	−38765	10			700 ms 200	(10^+)	14			1982	β^+=100;β^+p ?	
^{148}Yb	−30230#	400#			250# ms	0^+					β^+ ?;β^+p ?	

*^{148}Cs T : average 20Wu04=144(9) 18Li06=158(6) 17Li06=152(1) 17Wu04=144(5) **
*^{148}Cs T : 93Ru01=140(12) 86Hi08=158(7); others 86Wa17=130(10) 78Ko29=130(40) **
*^{148}Cs J : direct β^- decay feeding to 1- and 3- levels in ^{148}Ba in 18Li06 **
*^{148}Cs D : %β^-n average 86RuZU=25.1(2.5) 93Ru01=24(17) 18Li06=38(4) **
*^{148}Cs^m E : from 16Ya.A=45.2(0.1) **
*^{148}Ba T : average 17Wu04=621(11) 86Wa17=620(5) 84Ch02=607(25) 82Ga24=630(50) **
*^{148}La T : average 17Wu04=1.27(+0.10-0.09) 93Ru01=1.428(0.012) 86Wa17=1.40(0.02) **
*^{148}La T : 83Mu19=1.34(0.02) 82Ga24=1.55(0.03) 69Wi.A=1.29(0.08); **
*^{148}La T : Birge ratio=2.83 **
*^{148}La D : %β^-n unweighted average 93Ru01=0.24(0.02) 86Wa17=0.11(0.01); **
*^{148}La D : Birge ratio=5.81 **
*^{148}Nd T : lower limit is for 2β^- decay **
*^{148}Sm T : symmetrized from 16Ca43=6.4(+1.2-1.3) **
*^{148}Gd T : average 03Fu10=70.9(1.0) 81Pr06=74.6(3.0) **
*^{148}Ho^m T : average 93Al03=9.30(0.20) 89Ta11=9.59(0.15) **
*^{148}Ho^n E : 694.4 keV above ^{148}Ho^m from Ensdf2014 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{149}Xe	−33000#	300#			50# ms >550ns	$3/2^-$#		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{149}Cs	−43300#	400#			112.3 ms 2.5	$3/2^+$#	17	17Li06	TD	1979	β^-=100;β^-n=25 4;β^-2n ?	*
^{149}Ba	−52830.6	2.5			349 ms 4	$3/2^-$#	04	20Wu04	T	1993	β^-=100;β^-n=3.9 12	*
^{149}La	−60220	200			1.071 s 0.022	$(3/2^-)$	07	17Wu04	T	1979	β^-=100;β^-n=1.43 28	*
^{149}Ce	−66670	10			4.94 s 0.04	$3/2^-$#	04	96Ya.A	T	1974	β^-=100	
^{149}Pr	−71039	10			2.26 m 0.07	$(5/2^+)$	04			1964	β^-=100	
^{149}Nd	−74375.5	2.1			1.728 h 0.001	$5/2^-$*	04			1938	β^-=100	
^{149}Pm	−76064.4	2.2			53.08 h 0.05	$7/2^+$*	04			1947	β^-=100	
^{149}Pm^m	−75824.2	2.2	240.214	0.007	35 μs 3	$11/2^-$	04			1966	IT=100	
^{149}Sm	−77135.9	1.2			STABLE >2Py	$7/2^-$*	04			1933	IS=13.82 10;α ?	
^{149}Eu	−76441	4			93.1 d 0.4	$5/2^+$*	04			1959	ε=100	
^{149}Eu^m	−75945	4	496.386	0.002	2.45 μs 0.05	$11/2^-$	04			1961	IT=100	
^{149}Gd	−75127	3			9.28 d 0.10	$7/2^-$*	04			1951	β^+=100;α=4.3e-4 10	
^{149}Tb	−71489	4			4.118 h 0.025	$1/2^+$	04			1950	β^+=83.3 17;α=16.7 17	
^{149}Tb^m	−71453	4	35.78	0.13	4.16 m 0.04	$11/2^-$	04			1962	β^+≈100;α=0.022 3	
^{149}Dy	−67694	9			4.20 m 0.14	$7/2^-$	04			1958	β^+=100	
^{149}Dy^m	−65033	9	2661.1	0.4	490 ms 15	$27/2^-$	04	80Da18	J	1976	IT=99.3 3;β^+=0.7 3	*
^{149}Ho	−61646	12			21.1 s 0.2	$(11/2^-)$	04			1979	β^+=100	
^{149}Ho^m	−61597	12	48.80	0.20	56 s 3	$(1/2^+)$	04			1988	β^+=100	
^{149}Er	−53742	28			4 s 2	$(1/2^+)$	04			1984	β^+=100;β^+p=7 2	
^{149}Er^m	−53000	28	741.8	0.2	8.9 s 0.2	$(11/2^-)$	04			1984	β^+=96.5 7;IT=3.5 7; β^+p=0.18 7	
^{149}Er^n	−51131	28	2611.1	0.3	610 ns 80	$(19/2^+)$	04			1987	IT=100	
^{149}Er^p	−50440	30	3302	17	4.8 μs 0.1	$(27/2^-)$	04	87Br14	EJD	1987	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{149}Tm	−43940#	200#				900	ms	200	11/2$^-$	04			1987	β^+=100;β^+p=0.26 15	*
^{149}Tm^m	−43840#	210#	100#	50#		500#	ms		1/2$^+$#					β^+ ?;β^+p ?	*
^{149}Yb	−33330#	300#				700	ms	200	(1/2$^+$)	04	05Xu04	J	2001	β^+=100;β^+p≈100	*
*^{149}Cs	T : average 20Wu04=113(6) 17Wu04=113(8) 00KoZH=112(3),114(16); other														**
*^{149}Cs	T : 18Li06=80(3) 17Li06=80(4), outliers														**
*^{149}Ba	T : average 20Wu04=368(19) 17Wu04=352(6) 93Ru01=324(18) 86Wa17=346(6)														**
*^{149}Ba	D : %β^-n from 93Ru01; other 86Wa17=0.43(12), discrepant														**
*^{149}La	T : average 17Wu04=1.11(0.04) 93Ru01=1.066(0.034) 86Wa17=1.04(0.04)														**
*^{149}La	D : %β^-n average 93Ru01=1.74(0.13) 86Wa17=1.17(12), Birge ratio=3.22														**
*^{149}Dy^m	T : other 03Li42=11(1) s for q=66+ (bare ion)														**
*^{149}Er^p	E : 661+x keV above ^{149}Er^n and x<60 keV in 87Br14														**
*^{149}Tm	D : symmetrized from β^+p=0.2(+0.2-0.1)%														**
*^{149}Tm	J : favorite α decay from ^{153}Lu (J=11/2-)														**
*^{149}Tm^m	I : probably fed by α-decaying isomer in ^{153}Lu														**
*^{149}Yb	J : (1/2+,3/2+) in Ensdf2004 and 1/2 in 05Xu04; 06Xu07=(1/2-), however,														**
*^{149}Yb	J : no 1/2- gs or isomer for N=79 isotones														**
^{150}Xe	−28990#	300#				40#	ms	>550ns	0$^+$		18Sh11	I	2018	β^- ?;β^-n ?;β^-2n ?	
^{150}Cs	−38170#	400#				81.0	ms	2.6	(2$^-$)	17	18Li06	TD	1979	β^-=100;β^-n≈44;β^-2n ?	*
^{150}Ba	−49890	6				258	ms	5	0$^+$	17	02Pf04	TD	1994	β^-=100;β^-n=1.0 5	*
^{150}La	−56311.1	2.5				504	ms	15	(3$^+$)	13	17Wu04	T	1993	β^-=100;β^-n=2.7 3	*
^{150}Ce	−64847	12				6.05	s	0.07	0$^+$	13	15Ko23	T	1970	β^-=100	
^{150}Pr	−68301	9				6.19	s	0.16	1$^-$	13	15Ko23	J	1970	β^-=100	
^{150}Nd	−73680.0	1.1				9.3	Ey	0.7	0$^+$	13	20Ba.A	T	1937	IS=5.638 28;2β^-=100	
^{150}Pm	−73597	20				2.698	h	0.015	(1$^-$)	13			1952	β^-=100	
^{150}Sm	−77051.3	1.1				STABLE			0$^+$	13			1934	IS=7.37 9	
^{150}Eu	−74792	6				36.9	y	0.9	5$^-$	13			1950	β^+=100	
^{150}Eu^m	−74750	6	41.7	1.0		12.8	h	0.1	0$^-$*	13			1953	β^-=89 2;β^+=11 2;IT ?	
^{150}Gd	−75764	6				1.79	My	0.08	0$^+$	13			1953	α=100;2β^+ ?	
^{150}Tb	−71106	7				3.48	h	0.16	(2)$^-$	13			1959	β^+≈100;α ?	
^{150}Tb^m	−70645	26	461	27	MD	5.8	m	0.2	9$^+$	13			1993	β^+≈100;IT ?	
^{150}Dy	−69310	4				7.17	m	0.05	0$^+$	13			1959	β^+=66.4 18;α=33.6 18	*
^{150}Ho	−61946	14			*	76.8	s	1.8	(2)$^-$	13	93Al03	T	1963	β^+=100	*
^{150}Ho^m	−61950	50	0	50	BD*	23.3	s	0.3	(9)$^+$	13			1980	β^+=100	
^{150}Ho^n	−54050	50	7900	50		787	ns	36	(28$^-$)	13	06Fu06	JTE	2006	IT=100	*
^{150}Er	−57831	17				18.5	s	0.7	0$^+$	13			1982	β^+=100	
^{150}Er^m	−55035	17	2796.5	0.5		2.55	μs	0.10	10$^+$	13			1984	IT=100	
^{150}Tm	−46490#	200#			*&	3#	s		(1$^+$)		88Ni02	JI	1982	β^+=100	
^{150}Tm^m	−46350#	240#	140#	140#	*&	2.20	s	0.06	(6$^-$)	13			1981	β^+=100;β^+p=1.1 3	*
^{150}Tm^n	−45680#	240#	811#	140#		5.2	ms	0.3	10$^+$#	13			1984	IT=100[gs=0,m=100]	*
^{150}Yb	−38830#	300#				700#	ms	>200ns	0$^+$	13			2000	β^+ ?	
^{150}Lu	−24770#	300#				45	ms	3	(5$^-$)	13	03Gi10	J	1993	p≈100;β^+ ?	
^{150}Lu^m	−24750#	300#	22	5	p	40	μs	7	(8$^+$)	13	03Gi10	J	1998	p=100	*
*^{150}Cs	T : average 20Wu04=90(15) 18Li06=80(3) 17Wu04=84.4(8.2) 00KoZH=82(7)														**
*^{150}Cs	D : %β^-n other 00KoZH=20(10)														**
*^{150}Cs	J : direct β^- decay feeding to 1- and 3- levels in ^{150}Ba in 18Li06														**
*^{150}Ba	T : average 20Wu04=245(16) 17Wu04=259(5); other 02Pf04 300, compilation														**
*^{150}La	T : average 17Wu04t=510(+10-22) 95Ok02=510(30)														**
*^{150}Dy	D : %α average 74To07=31(3),36(3) 73Bi06=32(5) 77Ha48=36(5)														**
*^{150}Ho	T : average 93Al03=78(2) 82No08=72(4)														**
*^{150}Ho^n	E : 7912.1(2.3) keV above ^{150}Ho^m from Ensdf2013														**
*^{150}Tm^m	D : %β^+p symmetrized from 88Ni02=1.2(+2-4)														**
*^{150}Tm^n	E : 671.3(1.0) keV above ^{150}Tm^m from Ensdf2013														**
*^{150}Lu^m	T : symmetrized from 03Gi10=39(+8-6)														**
^{151}Cs	−34280#	500#				59	ms	19	3/2$^+$#	17	20Wu04	TD	1979	β^-=100;β^-n ?;β^-2n ?	*
^{151}Ba	−44940#	400#				167	ms	5	3/2$^-$#	17	17Wu04	T	1994	β^-=100;β^-n ?	*
^{151}La	−53310	440				465	ms	24	1/2$^+$#	17	17Wu04	TD	1994	β^-=100;β^-n ?	*
^{151}Ce	−61225	18				1.76	s	0.06	(3/2$^-$)	09	10Si03	J	1997	β^-=100	*
^{151}Pr	−66780	12				18.90	s	0.07	(3/2$^-$)	09			1990	β^-=100	
^{151}Pr^m	−66745	12	35.10	0.10		50	μs	8	(7/2$^+$)	09	12Ma03	T	2006	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{151}Nd	−70943.2	1.1				12.44	m	0.07	$3/2^+$	09			1938	β^-=100	
^{151}Pm	−73386	5				28.40	h	0.04	$5/2^+$*	09			1952	β^-=100	
^{151}Sm	−74576.5	1.1				94.6	y	0.6	$5/2^-$*	09	15Be23	T	1947	β^-=100	*
^{151}Sm^m	−74315.4	1.1	261.13	0.04		1.4	μs	0.1	$(11/2)^-$	09			1973	IT=100	
^{151}Eu	−74653.1	1.2				4.6	Ey	1.2	$5/2^+$*	09	14Ca13	T	1933	IS=47.81 6;α=100	*
^{151}Eu^m	−74456.9	1.2	196.245	0.010		58.9	μs	0.5	$11/2^-$	09			1958	IT=100	
^{151}Gd	−74188.9	3.0				123.9	d	1.0	$7/2^-$*	09			1950	ε=100;$\alpha\approx$1.1e-6 6	*
^{151}Tb	−71624	4				17.609	h	0.001	$1/2^+$*	09			1953	β^+99.9905 15;α=0.0095 15	
^{151}Tb^m	−71524	4	99.53	0.05		25	s	3	$11/2^-$	09			1978	IT=93.4 20;β^+=6.6 20	*
^{151}Dy	−68752	3				17.9	m	0.3	$7/2^-$*	09			1959	β^+=94.4 6;α=5.6 4	
^{151}Ho	−63623	8				35.2	s	0.1	$11/2^-$*	09	87NeZZ	J	1963	β^+=88 3;α=22 3	
^{151}Ho^m	−63582	8	41.0	0.2		47.2	s	1.3	$1/2^+$*	09	87NeZZ	J	1963	α=77 18;β^+=23 18	*
^{151}Er	−58266	16				23.5	s	2.0	$(7/2^-)$	09			1970	β^+=100	
^{151}Er^m	−55680	16	2586.0	0.5		580	ms	20	$(27/2^-)$	09			1980	IT=95.3 3;β^+=4.7 3	*
^{151}Er^n	−47979	16	10286.6	1.0		420	ns	50	$(65/2^-,61/2^+)$	09	09Fu05	J	1990	IT=100	
^{151}Tm	−50772	19				4.17	s	0.11	$(11/2^-)$	09			1982	β^+=100	
^{151}Tm^m	−50679	20	93	6	AD	6.6	s	2.0	$(1/2^+)$	09			1987	β^+=100	
^{151}Tm^n	−48116	19	2655.67	0.22		451	ns	34	$(27/2^-)$	09			1982	IT=100	
^{151}Yb	−41540	300				1.6	s	0.5	$(1/2^+)$	09	86To12	T	1985	β^+=100;β^+p=?	*
^{151}Yb^m	−40800#	320#	740#	100#		1.6	s	0.5	$(11/2^-)$	09	86To12	T	1986	$\beta^+\approx$100;β^+p=?;IT ?	*
^{151}Yb^n	−38910#	330#	2630#	141#		2.6	μs	0.7	$19/2^-$#	09			1993	IT=100	*
^{151}Yb^p	−38250#	330#	3287#	141#		20	μs	1	$27/2^-$#	09			1987	IT=100	*
^{151}Lu	−30300#	300#				78.4	ms	0.9	$11/2^-$	09	15Ta12	TJ	1982	p=?;β^+=?	*
^{151}Lu^m	−30240#	300#	57	4	p	16.0	μs	0.5	$3/2^+$	09	17Wa18	T	1998	p=100	*

*^{151}Cs T : average 20Wu04=48(28) 17Wu04=69(26) **
*^{151}Ba T : average 20Wu04=166(11) 17Wu04=167(5) **
*^{151}La T : symmetrized from 457(+30-18); other 20Wu04=510(330) **
*^{151}Ce T : average 17Wu04=1.71(0.09) 06Ko25=1.76 (0.06) **
*^{151}Ce I : isomer with T1/2=1.02(0.06)s suggested in Ensdf2009, but no sufficient **
*^{151}Ce I : experimental evidence exists, so it is not trusted by Nubase **
*^{151}Sm T : other (recent) 09He22=96.6(2.4) **
*^{151}Eu J : 90Al34=5/2 **
*^{151}Gd D : %α symmetrized from α/KXrays=0.8(+0.8-0.4)e-8 in 65Si06 **
*^{151}Tb^m J : E3 to 5/2+ following by E2 to 1/2+ **
*^{151}Ho^m D : %α symmetrized from α=80(+15-20) **
*^{151}Er^m T : other 03Li42=19(3) s for q=68+ (bare ion) **
*^{151}Yb T : derived from 1.6(0.1)s for a mixture of gs and isomer that have almost **
*^{151}Yb T : the same half-life **
*^{151}Yb^m E : 740# keV estimated in 90Ak01 **
*^{151}Yb^n E : 1790+x keV above ^{151}Yb^m in 93Ni05; x=100#(100#) **
*^{151}Yb^p E : 657 keV above ^{151}Yb^n in 93Ni05 **
*^{151}Lu T : average 15Ta12=78(1) 99Bi14=80(2) **
*^{151}Lu^m T : average 17Wa18=15.4(0.8) 15Ta12=17(1) 99Bi14=16(1) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{152}Cs	−29130#	500#				17#	ms			18	87Ra12	I	1987	β^- ?;β^-n ?	
^{152}Ba	−41610#	400#				139	ms	8	0^+	17	17Wu04	TD	2010	β^-=100;β^-n ?	*
^{152}La	−49290#	300#				287	ms	16	2^-#	17	17Wu04	TD	1994	β^-=100;β^-n ?	*
^{152}Ce	−58980#	200#				1.42	s	0.02	0^+	13	17Wu04	T	1990	β^-=100	
^{152}Pr	−63758	19				3.57	s	0.11	4^+	13	99To04	J	1983	β^-=100	*
^{152}Pr^m	−63643	19	115.1	0.3		4.16	μs	0.10	(1^+)	13	18Al14	TJE	1990	IT=100	*
^{152}Nd	−70150	24				11.4	m	0.2	0^+	13			1969	β^-=100	
^{152}Pm	−71254	26			*	4.12	m	0.08	1^+	13			1958	β^-=100	
^{152}Pm^m	−71110	80	140	90	BD*	7.52	m	0.08	$4^{(-)}$	13			1971	β^-=100	*
^{152}Pm^n			*non − exist*		EU	13.8	m	0.2	(8)	13			1971	β^-=100;IT ?	*
^{152}Sm	−74763.0	1.0				STABLE			0^+	13			1933	IS=26.74 9	
^{152}Eu	−72888.5	1.2				13.517	y	0.006	3^-*	13	FGK209	T	1938	β^+=72.08 13;β^-=27.92 13	
^{152}Eu^m	−72842.9	1.2	45.5998	0.0004		9.3116	h	0.0013	0^-*	13			1958	β^-=73 3;β^+=27 3	
^{152}Eu^n	−72823.2	1.2	65.2969	0.0004		940	ns	80	1^-	13			1978	IT=100	
^{152}Eu^p	−72810.3	1.2	78.2331	0.0004		165	ns	10	1^+	13			1978	IT=100	
^{152}Eu^q	−72798.7	1.2	89.8496	0.0004		384	ns	10	4^+	13			1970	IT=100	
^{152}Eu^r	−72740.6	1.2	147.86	0.10		95.8	m	0.4	8^-	13	15Hu02	T	1963	IT=100	
^{152}Gd	−74707.3	1.0				108	Ty	8	0^+	13			1938	IS=0.20 3;α=100;2β^+ ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{152}Tb	−70720	40				17.5	h	0.1	2−∗	13			1959	β+=100;α ?	
^{152}Tb^m	−70380	40	342.15	0.16		960	ns	10	5−	13			1972	IT=100	
^{152}Tb^n	−70220	40	501.74	0.19		4.2	m	0.1	8+	13			1971	IT=78.9 6;β+=21.1 6	
^{152}Dy	−70118	5				2.38	h	0.02	0+	13			1958	ε=99.900 7;α=0.100 7	
^{152}Ho	−63605	13				161.8	s	0.3	2−∗	13			1963	β+=88 3;α=12 3	
^{152}Ho^m	−63445	13	160	3	AD	49.8	s	0.2	9+∗	13			1963	β+=89.2 17;α=10.8 17	∗
^{152}Ho^n	−60585	13	3019.59	0.19		8.4	μs	0.3	19−	13			1997	IT=100	
^{152}Er	−60500	9				10.3	s	0.1	0+	13			1963	α=90 4;β+=10 4	
^{152}Tm	−51720	50			*	8.0	s	1.0	(2)−	13			1980	β+=100	
^{152}Tm^m	−51820	240	−100	250	*	5.2	s	0.6	(9)+	13			1980	β+=100	
^{152}Tm^n	−49270	250	2455	250		301	ns	7	(17+)	13	18Na20	T	1986	IT=100	∗
^{152}Yb	−46270	150				3.03	s	0.06	0+	13			1982	β+=100	
^{152}Yb^m	−43530	150	2744.5	1.0		30	μs	1	(10+)	13			1995	IT=100	
^{152}Lu	−33420#	200#				650	ms	70	(4−,5−,6−)	13	88Ni02	T	1987	β+=100;β+p=15 7	∗

∗^{152}Ba T : other 20Wu04=148(21) ∗∗
∗^{152}La T : symmetrized from 17Wu04=298(+6-23); other 20Wu04=270(100) ∗∗
∗^{152}Pr T : average 90An31=3.7(0.2) 85Br08=3.8(0.2) 83Hi05=3.24(0.19) ∗∗
∗^{152}Pr^m T : average 18Al14=4.7(0.3) 95Ya21=4.1(0.1). other: 90Ta07=1.0(0.3) ∗∗
∗^{152}Pm^m J : parity from 77Ya07 based on log ft values not unambiguous; see 71Da19; ∗∗
∗^{152}Pm^m J : alternative K=4+ and the same configuration as the gs is possible ∗∗
∗^{152}Pm^n I : introduced in 71Da19, but the suggested 1941-keV and 2172-keV levels ∗∗
∗^{152}Pm^n I : in the daughter ^{152}Sm nuclide that are fed by the isomer, ∗∗
∗^{152}Pm^n I : do not exist (1941 keV) or don't have high spin (1,2+ for 2172 keV) ∗∗
∗^{152}Pm^n I : in Ensdf2013; not confirmed in 77Ya07 ∗∗
∗^{152}Ho^m E : Ensdf13=160(1) from α decay, but uncertainty not trusted ∗∗
∗^{152}Tm^n E : 2555.05(0.19) above ^{152}Tm^m ∗∗
∗^{152}Tm^n T : average 18Na20=304(8) 86Mc14=294(12) ∗∗
∗^{152}Lu T : average 88Ni02=600(100) 87To02=700(100) ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{153}Ba	−36470#	400#				113	ms	39	5/2−#	20	20Wu04	TD	2016	β−=100;β−n ?;β−2n ?	∗
^{153}La	−46060#	300#				245	ms	18	1/2+#	20	17Wu04	TD	1994	β−=100;β−n ?;β−2n ?	∗
^{153}Ce	−54910#	200#				865	ms	25	3/2−#	20	17Wu04	TD	1994	β−=100;β−n ?	
^{153}Pr	−61568	12				4.28	s	0.11	3/2−#	20	90An31	T	1987	β−=100;β−n ?	∗
^{153}Nd	−67330.4	2.7				31.6	s	1.0	(3/2)−	20			1987	β−=100	
^{153}Nd^m	−67138.7	2.7	191.71	0.16		1.10	μs	0.04	(5/2)+	20	10Si03	TJ	1996	IT=100	∗
^{153}Pm	−70648	9				5.25	m	0.02	5/2−	20			1962	β−=100	
^{153}Sm	−72560.1	1.0				46.2846	h	0.0023	3/2+∗	20	FGK209	T	1938	β−=100	
^{153}Sm^m	−72461.7	1.0	98.39	0.10		10.6	ms	0.3	11/2−	20			1971	IT=100	
^{153}Eu	−73367.5	1.2				STABLE		>550Py	5/2+∗	20	12Da16	T	1933	IS=52.19 6	∗
^{153}Eu^m	−71596.5	1.3	1771.0	0.4		475	ns	10	19/2−	20			2000	IT=100	
^{153}Gd	−72882.9	1.0				240.6	d	0.7	3/2−∗	20	14Un01	T	1947	ε=100	∗
^{153}Gd^m	−72787.7	1.0	95.1737	0.0008		3.5	μs	0.4	9/2+	20			1979	IT=100	
^{153}Gd^n	−72711.7	1.0	171.188	0.004		76.0	μs	1.4	(11/2−)	20			1967	IT=100	
^{153}Tb	−71314	4				2.34	d	0.01	5/2+∗	20			1957	β+=100	
^{153}Tb^m	−71151	4	163.175	0.005		186	μs	4	11/2−	20			1965	IT=100	
^{153}Dy	−69143	4				6.4	h	0.1	7/2−∗	20			1958	β+=99.9906 14; α=0.0094 14	
^{153}Ho	−65012	5				2.01	m	0.03	11/2−∗	20			1963	β+=99.949 25;α=0.051 25	
^{153}Ho^m	−64943	5	68.7	0.3		9.3	m	0.5	1/2+∗	20			1963	β+=99.82 8;α=0.18 8	
^{153}Ho^n	−62240	5	2772.3	1.4		229	ns	2	31/2+	20	16Pr06	J	1980	IT=100	
^{153}Er	−60467	9				37.1	s	0.2	7/2−∗	20	85Ah.A	J	1963	α=53 3;β+=47 3	∗
^{153}Er^m	−57669	9	2798.2	1.0		373	ns	9	(27/2−)	20			1979	IT=100	
^{153}Er^n	−55219	9	5248.1	1.0		248	ns	32	(41/2−)	20			1979	IT=100	
^{153}Tm	−53973	12				1.48	s	0.01	(11/2−)	20			1964	α=91 3;β+=9 3	
^{153}Tm^m	−53930	12	43.2	0.2		2.5	s	0.2	(1/2+)	20			1988	α=92 3;β+=8 3	
^{153}Yb	−47160#	200#				4.2	s	0.2	7/2−	20	88Wi05	D	1977	β+=?;α ?;β+p=0.008 2	
^{153}Yb^m	−44530#	210#	2630#	50#		15	μs	1	27/2−	20			1989	IT=100	∗
^{153}Lu	−38380	150				900	ms	200	11/2−	20	97Ir01	D	1989	α=?;β+ ?;p=0	∗
^{153}Lu^m	−38300	150	80	5	IT	1#	s		1/2+	20	97Ir01	EDJ	1997	α ?;β+ ?;IT ?;p=0	
^{153}Lu^n	−35880	150	2502.5	0.4		> 100	ns		23/2−	20			1993	IT=100	
^{153}Lu^p	−35750	150	2632.9	0.5		15	μs	3	27/2−	20			1993	IT=100	
^{153}Hf	−27300#	300#				400#	ms	>200ns	1/2+#	20	00So11	I	2000	β+ ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{153}Hf^m	−26550#	320#	750#	100#		500#	ms		11/2$^-$#					β^+ ?;IT ?	

*^{153}Ba T : average 20Wu04=109(59) 17Wu04=116(52) **
*^{153}La T : other 20Wu04=210(120) **
*^{153}Pr T : other 17Wu04=4.68(0.70) 87Gr12=4.3(0.2) **
*^{153}Nd^m T : average 10Si03=1.17(0.07) 96Ya12=1.06(0.05) **
*^{153}Eu J : 85Ah03,90Al34=5/2 **
*^{153}Gd T : unweighted average 14Un01=239.29(0.10) 72Em01=241.6(0.2),240.9(0.6); **
*^{153}Gd T : Birge ratio=7.4; other (discrepant) 89Po21=226.7(4.2) **
*^{153}Er J : also 89Ot.A **
*^{153}Yb^m E : from 93Mc03=2579 (23/2-)+x keV; x=50#(50#) keV by Nubase, probably **
*^{153}Yb^m E : overlaps with 51-keV E1 **
*^{153}Lu D : %p from 97Ir01=0 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{154}Ba	−32920#	500#				53	ms	48	0$^+$	17	17Wu04	TD	2017	β^-=100	
^{154}La	−41530#	300#				161	ms	15	2$^-$#	17	17Wu04	TD	2017	β^-=100;β^-n ?;β^-2n ?	*
^{154}Ce	−52220#	200#				722	ms	14	0$^+$	17	17Wu04	TD	1994	β^-=100;β^-n ?	
^{154}Pr	−57860	100				2.30	s	0.09	(3$^+$)	09	17Wu04	T	1988	β^-=100;β^-n ?	*
^{154}Nd	−65579.6	1.0				25.9	s	0.2	0$^+$	09			1970	β^-=100	
^{154}Nd^m	−64281.7	1.1	1297.9	0.4		3.2	μs	0.3	(4$^-$)	09	09Si21	ETJ	1970	IT=100	*
^{154}Pm	−68267	25			*	2.68	m	0.07	(4$^+$)	09	12So10	J	1958	β^-=100	
^{154}Pm^m	−68490	40	−230	50	IT*	1.73	m	0.10	(1$^-$)	09	12So10	J	1958	β^-=100	
^{154}Sm	−72455.6	1.3				STABLE		>2.3Ey	0$^+$	09			1933	IS=22.74 14;2β^- ?	*
^{154}Eu	−71738.4	1.2				8.592	y	0.003	3$^-$*	09	FGK209	T	1947	β^-=99.982 12;ε=0.018 12	
^{154}Eu^m	−71670.2	1.2	68.1702	0.0004		2.2	μs	0.1	2$^+$	09			1964	IT=100	
^{154}Eu^n	−71593.1	1.2	145.3	0.3		46.3	m	0.4	(8$^-$)	09			1975	IT=100	
^{154}Gd	−73706.4	1.0				STABLE			0$^+$	09			1938	IS=2.18 2	
^{154}Tb	−70160	50			*&	9.994	h	0.039	3$^-$*	09	09Gy01	T	1972	β^+=100;β^- ?	
^{154}Tb^m	−70030#	70#	130#	50#	*&	21.5	h	0.4	0$^-$*	09			1950	$\beta^+\approx$100;IT ?;β^- ?	
^{154}Tb^n	−69960#	160#	200#	150#	*	22.7	h	0.5	7$^-$	09			1972	$\beta^+\approx$100;IT ?	
^{154}Tb^p	−69760#	160#	405#	150#		513	ns	42		09			1982	IT=100	*
^{154}Dy	−70394	7				3.0	My	1.5	0$^+$	09			1961	α=100;2β^+ ?	
^{154}Ho	−64639	8				11.76	m	0.19	2$^-$*	09			1966	β^+=99.981 5;α=0.019 5	
^{154}Ho^m	−64397	27	243	28	AD	3.10	m	0.14	8$^+$*	09			1968	β^+=100;α<0.001;IT$\approx$0	
^{154}Er	−62605	5				3.73	m	0.09	0$^+$	09			1963	$\beta^+\approx$100;α=0.47 13	
^{154}Tm	−54427	14			*	8.1	s	0.3	(2)$^-$	09			1964	α=54 5;β^+=46 5	
^{154}Tm^m	−54350	50	70	50	BD*	3.30	s	0.07	(9)$^+$	09			1964	α=58 5;β^+=42 5;IT ?	
^{154}Yb	−49932	17				409	ms	2	0$^+$	09			1964	α=92.6 12;β^+=7.4 12	
^{154}Lu	−39670#	200#				1#	s		(2$^-$)	09			1981	β^+ ?;α ?	
^{154}Lu^m	−39600#	200#	62	12	AD	1.12	s	0.08	(9$^+$)	09	88Vi02	D	1981	$\beta^+\approx$100;β^+p=?;$\beta^+\alpha$=?;α ?	*
^{154}Lu^n	−36950#	220#	2724#	100#		35	μs	3	(17$^+$)	09			1990	IT=100	*
^{154}Hf	−32730#	300#				2	s	1	0$^+$	09			1981	$\beta^+\approx$100;$\alpha\approx$0	
^{154}Hf^m	−30010#	300#	2721#	50#		9	μs	4	(10$^+$)	09			1989	IT=100	*

*^{154}La T : other 20Wu04=221(89) **
*^{154}Pr T : average 17Wu04=2.29(0.20) 88Ka16=2.3(0.1) **
*^{154}Nd^m E : from a least-squares fit to gamma-ray energies in 09Si21 **
*^{154}Nd^m I : other Ensdf2009 quotes this isomer twice: 233.2+x keV (1.3 us) and **
*^{154}Nd^m I : 1349 keV (5-, >1 us); not trusted **
*^{154}Sm T : 2ν-$\beta\beta$ to 2+ from 96De60 **
*^{154}Tb J : 70Ad09=3; conf p3/2[411]n3/2[521], K=3- and GM rule **
*^{154}Tb^p E : 82Be46=53.9,60.4 abd 90.1-keV gammas show 500 ns half-life; assumed by **
*^{154}Tb^p E : Nubase above ^{154}Tb^n since the level is populated in the **
*^{154}Tb^p E : (^{11}B,5n) reaction that favors high spin **
*^{154}Lu^m D : %β^+p and %$\beta^+\alpha$ modes observed in 88Vi02; β^+p confirmed in 90Sh.A **
*^{154}Lu^n E : 2431.3 + 130.4 + z keV above ^{154}Lu^m ; z=100#(100#) keV **
*^{154}Hf^m E : 93Mc03=2671+x keV; x=50#(50#) keV by Nubase **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{155}La	−37930#	400#				101	ms	28	1/2$^+$#	19	17Wu04	T	2016	β^-=100;β^-n ?;β^-2n ?	*
^{155}Ce	−47780#	300#				313	ms	7	5/2$^-$#	19			1994	β^-=100;β^-n ?	
^{155}Pr	−55415	17				1.47	s	0.3	3/2$^-$#	19			1992	β^-=100;β^-n ?	
^{155}Nd	−62284	9				8.9	s	0.2	(3/2$^-$)	19			1986	β^-=100	
^{155}Pm	−66940	5				41.5	s	0.2	(5/2$^-$)	19			1982	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{155}Sm	−70191.2	1.3				22.18	m	0.06	3/2−*	19			1951	β^-=100	
^{155}Sm^m	−70174.7	1.3	16.5467	0.0019		2.8	μs	0.5	5/2+	19			2010	IT=100	
^{155}Sm^n	−69653.2	1.3	538.03	0.19		1.00	μs	0.08	11/2−	19	10Si03	TJ	2010	IT=100	
^{155}Eu	−71818.3	1.3				4.742	y	0.008	5/2+*	19	14Un01	T	1947	β^-=100	*
^{155}Gd	−72070.3	1.0				STABLE			3/2−*	19			1933	IS=14.80 9	
^{155}Gd^m	−71949.2	1.0	121.10	0.19		31.97	ms	0.27	11/2−	19			1967	IT=100	
^{155}Tb	−71250	10				5.32	d	0.06	3/2+*	19			1957	ε=100	
^{155}Dy	−69156	10				9.9	h	0.2	3/2−*	19			1958	β^+=100	
^{155}Dy^m	−68922	10	234.33	0.03		6	μs	1	11/2−	19			1970	IT=100	
^{155}Ho	−66040	17				48	m	2	5/2+*	19			1959	β^+=100	
^{155}Ho^m	−65898	17	141.87	0.11		880	μs	80	11/2−	19			1984	IT=100	
^{155}Er	−62209	6				5.3	m	0.3	7/2−	19	FGK211	J	1969	β^+=99.978 7;α=0.022 7	*
^{155}Tm	−56626	10				21.6	s	0.2	11/2−	19			1971	β^+=99.17 17;α=0.83 17	
^{155}Tm^m	−56585	12	41	6	AD	45	s	4	1/2+	19			1990	$\beta^+\approx$100;α ?	
^{155}Yb	−50503	17				1.793	s	0.020	(7/2−)	19			1964	α=89 5;β^+=11 5	
^{155}Lu	−42545	19				68	ms	2	11/2−	19			1965	α=90 2;β^+=10 2	
^{155}Lu^m	−42524	20	21	4	AD	138	ms	9	1/2+	19			1967	α=76 16;β^+=24 16	
^{155}Lu^n	−40765	19	1780.3	1.8	AD	2.69	ms	0.03	25/2−#	19			1981	$\alpha\approx$100;IT ?	
^{155}Hf	−34310#	300#				843	ms	30	7/2−#	19			1981	$\beta^+\approx$100;α ?	
^{155}Ta	−23990#	300#				3.2	ms	1.3	11/2−	19	07Pa27	T	2007	p=100	*

*^{155}La T : other 20Wu04=94(59) **
*^{155}Eu T : average 14Un01=1731(3) d 98Si12=1739(8) d, supersedes 83Wa26=1737(23) d, **
*^{155}Eu T : 93Th04=1735(22) d **
*^{155}Er J : favored α decay to ^{151}Dy, J=7/2- **
*^{155}Ta T : symmetrized from 07Pa27=2.9(+1.5-1.1); other 99Uu01=12(+4-3) us **
*^{155}Ta T : strongly conflicting result - most likely ^{159}Re^m decay **
*^{155}Ta D : E(p): 07Pa27=1444(15) keV 99Uu01=1776(10) keV, the later similar to **
*^{155}Ta D : E(p)=1805(20) keV for ^{159}Re^m. The energy balance **
*^{155}Ta D : Qp(^{159}Re^m)+Qα(^{158}W)=Qα(^{159}Re^m)+ **
*^{155}Ta D : Qp(^{155}Ta)= 8422 keV supports the 07Pa27 data **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{156}La	−33050#	400#				84	ms	78	4+#	17	17Wu04	TD	2017	β^-=100;β^-n ?	
^{156}Ce	−44820#	300#				233	ms	9	0+	17	17Wu04	TD	2017	β^-=100;β^-n ?	
^{156}Pr	−51449.3	1.0				444	ms	6	1+#	17	17Wu04	TD	1992	β^-=100;β^-n ?	
^{156}Nd	−60202.1	1.3				5.06	s	0.13	0+	12	07Sh05	T	1987	β^-=100	*
^{156}Nd^m	−58770.8	1.4	1431.3	0.4		365	ns	145	(5−)	12	09Si21	ET	1998	IT=100	
^{156}Pm	−64166.8	1.2				27.4	s	0.5	4+	12	16Ko.A	TJ	1986	β^-=100	*
^{156}Pm^m	−64016.5	1.2	150.30	0.10		2.3	s	2.0	1+#	12	07Sh05	ETD	2007	IT$\approx$98;$\beta^-\approx$2	*
^{156}Sm	−69361	9				9.4	h	0.2	0+	12			1951	β^-=100	
^{156}Sm^m	−67963	9	1397.55	0.09		185	ns	7	5−	12			1974	IT=100	*
^{156}Eu	−70083	4				15.19	d	0.08	0+*	12			1947	β^-=100	*
^{156}Gd	−72535.3	1.0				STABLE			0+	12			1933	IS=20.47 3	
^{156}Gd^m	−70397.7	1.0	2137.60	0.05		1.3	μs	0.1	7−	12			1969	IT=100	
^{156}Tb	−70091	4				5.35	d	0.10	3−*	12			1950	$\beta^+\approx$100;β^- ?	
^{156}Tb^m	−70003	4	88.4	0.2		5.3	h	0.2	(0+)	12			1950	IT=?;β^+=?	
^{156}Tb^n	−69990#	50#	100#	50#		24.4	h	1.0	(7−)	12			1970	IT=?;β^- ?	*
^{156}Dy	−70529.4	1.0				STABLE		>1Ey	0+	12	58Ri23	T	1948	IS=0.056 3;α ?;2β^+ ?	*
^{156}Ho	−65540	40				56	m	1	4−*	12			1957	β^+=100	
^{156}Ho^m	−65490	40	52.37	0.30		9.5	s	1.5	1−*	12			1995	IT$\approx$100;β^+ ?	*
^{156}Ho^n	−65304	28	230	50	MD	7.6	m	0.3	9+	12			1975	$\beta^+\approx$75;IT ?	
^{156}Er	−64212	25				19.5	m	1.0	0+	12	96By.A	D	1967	β^+=100;α=1.2e-5 3	
^{156}Tm	−56834	14				83.8	s	1.8	2−	12			1971	$\beta^+\approx$100;α=0.064 10	
^{156}Tm^m	−56430#	200#	400#	200#	EU	∼ 400	ns		(11−)	12			1985	IT=100	*
^{156}Yb	−53266	9				26.1	s	0.7	0+	12			1970	β^+=90 2;α=10 2	
^{156}Lu	−43700	50			*	494	ms	12	(2)−	12			1965	α=100;β^+ ?	
^{156}Lu^m	−43680	240	10	250	*	198	ms	2	10+	12	18Le10	J	1979	$\alpha\approx$100;β^+ ?	
^{156}Lu^n	−41090	250	2611	250		179	ns	4	19−		18Le10	ETJ	2018	IT=100	*
^{156}Hf	−37820	150				23	ms	1	0+	12	96Pa01	D	1979	$\alpha\approx$100;β^+ ?	
^{156}Hf^m	−35860	150	1958.8	1.0	AD	480	μs	40	(8+)	12	96Pa01	T	1979	$\alpha\approx$100;IT ?	*
^{156}Ta	−26000#	300#				106	ms	4	(2−)	12			1992	p=71 3;β^+=29 3	
^{156}Ta^m	−25910#	300#	94	8	AD	360	ms	40	(9+)	12			1993	β^+=95.8 9;p=4.2 9	

*^{156}Nd T : others 89Ok.A=5.51(0.10) 87Gr12=5.47(0.11), see discussion in 07Sh05. **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

(Explanation of Table on page 030001-16)

∗^{156}Nd T : other: 17Wu04=5.2(1.4) ∗∗
∗^{156}Pm T : unweighed average 16Ko.A=27.78(0.07) 87Gr12=26.70(0.10); ∗∗
∗^{156}Pm T : Birge ratio=8.85 ∗∗
∗^{156}Pm^m E: other 20Or03=152.2(2.7) (PI-ICR) ∗∗
∗^{156}Sm^m T : other (recent) 09Si21=186(44) ∗∗
∗^{156}Eu J : 90Al34=0 ∗∗
∗^{156}Tb^n E : from 49.630+x keV; x=50#(50#) keV estimated by Nubase ∗∗
∗^{156}Dy T : the lower limit is for α decay ∗∗
∗^{156}Ho^m E : uncertainty estimated by Nubase ∗∗
∗^{156}Tm^m E : 203.6 keV above unknown level ∗∗
∗^{156}Lu^n E : 18Le10=2601.0(1.4) keV above ^{156}Lu^m ∗∗
∗^{156}Hf^m T : average 96Pa01=520(10) 81Ho.A=444(17) ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{157}La	−29070#	300#					30#	ms	>550ns	$1/2^+$#		18Sh11	I	2018	β^- ?;β^-n ?	
^{157}Ce	−39930#	400#					175	ms	41	$7/2^+$#	17	17Wu04	TD	2017	β^-=100;β^-n ?	
^{157}Pr	−48435	3					307	ms	21	$3/2^-$#	17	17Wu04	TD	2017	β^-=100;β^-n ?	∗
^{157}Nd	−56494.1	2.1					1.15	s	0.03	$5/2^-$#	17	17Wu04	TD	1992	β^-=100	
^{157}Pm	−62297	7					10.56	s	0.10	$(5/2^-)$	16			1987	β^-=100	
^{157}Sm	−66678	4					8.03	m	0.07	$3/2^-$#	16			1973	β^-=100	
^{157}Eu	−69459	4					15.18	h	0.03	$5/2^+$∗	16			1951	β^-=100	
^{157}Gd	−70823.9	1.0					STABLE			$3/2^-$∗	16			1933	IS=15.65 4	
^{157}Gd^m	−70760.0	1.0	63.916	0.005			460	ns	40	$5/2^+$	16			1964	IT=100	
^{157}Gd^n	−70397.4	1.0	426.539	0.023			18.5	μs	2.3	$11/2^-$	16			1961	IT=100	
^{157}Tb	−70763.8	1.0					71	y	7	$3/2^+$	16			1960	ε=100	
^{157}Dy	−69425	5					8.14	h	0.04	$3/2^-$∗	16			1953	β^+=100	
^{157}Dy^m	−69263	5	161.99	0.03			1.3	μs	0.2	$9/2^+$	16			1974	IT=100	
^{157}Dy^n	−69226	5	199.38	0.07			21.6	ms	1.6	$11/2^-$	16			1970	IT=100	
^{157}Ho	−66833	23					12.6	m	0.2	$7/2^-$∗	16			1966	β^+=100	
^{157}Er	−63414	27					18.65	m	0.10	$3/2^-$∗	16			1966	β^+=100	
^{157}Er^m	−63259	27	155.4	0.3			76	ms	6	$9/2^+$	16			1971	IT=100	
^{157}Tm	−58709	28				*	3.63	m	0.09	$1/2^+$∗	16	96By.A	D	1974	β^+=100;α=7.5e-4 25	
^{157}Tm^m	−58610#	60#	100#	50#		*	1.6	s		$7/2^-$#		08VaZV	TJ	2008	β^+ ?; IT ?	
^{157}Yb	−53420	11					38.6	s	1.0	$7/2^-$∗	16			1970	β^+≈100;α=?	
^{157}Lu	−46440	12					7.7	s	2.0	$(1/2^+)$	16			1977	β^+ ?;α=?	∗
^{157}Lu^m	−46419	12	20.9	2.0	AD		4.79	s	0.12	$(11/2^-)$	16			1972	β^+=92.3 19;α=7.7 19	∗
^{157}Hf	−38860#	200#					115	ms	1	$7/2^-$	16			1965	α=94 4;β^+=14 4	∗
^{157}Ta	−29600	150					10.1	ms	0.4	$1/2^+$	16			1979	α=96.6 12;p=3.4 12;β^+ ?	
^{157}Ta^m	−29570	150	22	5	AD		4.3	ms	0.1	$11/2^-$	16			1996	α≈100;β^+ ?;p=0	
^{157}Ta^n	−28000	150	1593	9	AD		1.7	ms	0.1	$25/2^-$#	16			1996	α=100	
^{157}W	−19690#	400#					275	ms	40	$(7/2^-)$	16	10Bi03	D	2010	β^+=100;α=0	
^{157}W^p	−19370#	400#	320	30	AD					$(9/2^-)$	16			2010	IT ?	

∗^{157}Pr T : symmetrized from 17Wu04=295(+29-11) ∗∗
∗^{157}Lu T : unweighted average 91To09=5.7(0.5) 91Le15,92Po14=9.6(0.8); ∗∗
∗^{157}Lu T : Birge ratio=4.13 ∗∗
∗^{157}Lu^m D : %α average 91To09=18(5) 79Ho10=6(2); Birge ratio=2.23 ∗∗
∗^{157}Hf J : favored α decay to J=7/2- gs in ^{153}Yb ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)				Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{158}Ce	−36540#	400#					99	ms	93	0^+	17			2016	β^-=100;β^-n ?	
^{158}Pr	−44150#	300#					181	ms	14	5^-#	17			2016	β^-=100;β^-n ?	
^{158}Nd	−53835.1	1.3					810	ms	30	0^+	17	17Wu04	TD	1992	β^-=100	∗
^{158}Nd^m	−52187.0	1.9	1648.1	1.4			339	ns	20	(6^-)	17			2016	IT=100	
^{158}Pm	−59106.1	0.9					4.8	s	0.5	$(0^+,1^+)$#	17			1987	β^-=100	
^{158}Pm^m	−58960#	50#	150#	50#			> 16	μs		5^+#	17	15YoZX	EDT	2015	IT=?;β^- ?	∗
^{158}Sm	−65252	5					5.30	m	0.03	0^+	17			1970	β^-=100	
^{158}Eu	−67270.5	2.0					45.9	m	0.2	1^-∗	17			1951	β^-=100	∗
^{158}Gd	−70690.0	1.0					STABLE			0^+	17			1933	IS=24.84 8	
^{158}Tb	−69470.9	1.3					180	y	11	3^-∗	04			1957	β^+=83.4 7;β^-=16.6 7	∗
^{158}Tb^m	−69360.6	1.8	110.3	1.2			10.70	s	0.17	0^-	17			1957	IT≈100;β^- ?;β^+ ?	
^{158}Tb^n	−69082.5	1.3	388.39	0.11			400	μs	40	7^-	17			1961	IT=100	
^{158}Dy	−70407.2	2.3					STABLE			0^+	17			1938	IS=0.095 3;α ?;2β^+ ?	
^{158}Ho	−66187	27					11.3	m	0.4	5^+∗	17			1961	β^+≈100;α ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{158}Ho^{m}	−66120	27	67.20	0.01		28	m	2	2$^-$*	17			1960	IT≈91 6;β^+≈9 6	*
^{158}Ho^{n}	−66095	27	91.595	0.012		140	ns	25	(2$^-$)	17			2005	IT=100	*
^{158}Ho^{p}	−66010#	80#	180#	70#		21.3	m	2.3	(9$^+$)	17			1970	β^+≈100;IT ?	
^{158}Er	−65304	25				2.29	h	0.06	0$^+$	17			1961	ε=100	
^{158}Tm	−58703	25			*	3.98	m	0.06	2$^-$*	17			1970	β^+=100	
^{158}Tm^{m}	−58600#	60#	100#	50#	*	∼20	s		5$^-$#	17	81Dr07	IT	1981	IT ?;ε ?	*
^{158}Yb	−56010	8				1.49	m	0.13	0$^+$	17			1967	β^+≈100;α≈0.0021 12	
^{158}Lu	−47212	15				10.6	s	0.3	(2)$^-$	17			1979	β^+=99.09 20;α=0.91 20	
^{158}Hf	−42102	17				2.85	s	0.07	0$^+$	17			1965	β^+=55.7 19;α=44.3 19	
^{158}Ta	−31120#	200#				49	ms	4	(2)$^-$	17	97Da07	TD	1979	α≈100;β^+ ?	*
^{158}Ta^{m}	−30980#	200#	141	11	AD	36.0	ms	0.8	(9)$^+$	17	97Da07	ETJ	1979	α=95 5;β^+ ?;IT ?	*
^{158}Ta^{n}	−28310#	200#	2808	16		6.1	μs	0.1	(19$^-$)	17			2014	IT=98.6 2;α=1.4 2	*
^{158}W	−23690#	300#				1.43	ms	0.18	0$^+$	17	19Hi06	T	1981	α=100	*
^{158}W^{m}	−21800#	300#	1889	8	AD	143	μs	19	(8$^+$)	17			1995	α=100;IT ?	

*^{158}Nd T : symmetrized from 17Wu04=820(+15-36) **
*^{158}Pm^{m} E : 15YoZX=121+x (121-keV gamma ray below the isomer); x=30#(50#) by Nubase **
*^{158}Eu J : 90Al34=1 **
*^{158}Tb J : 68Ea04=3 **
*^{158}Ho^{m} D : %IT from Ensdf2017>81 **
*^{158}Ho^{n} J : E1 from 1+; not fed directly in ^{158}Er (J=0+) β^+ decay **
*^{158}Tm^{m} I : 20 s activity, following observation of gammas in ^{158}Er ε decay **
*^{158}Tm^{m} I : in 81Dr07, is adopted. Note, that 20 ns appears in the level scheme **
*^{158}Tm^{m} I : in Fig. 2 (81Dr07), which seems to be a misprint. This is a spin-trap **
*^{158}Tm^{m} I : isomer and the suggested 20 ns half-life in Ensdf17 is unrealistic. **
*^{158}Tm^{m} I : The configuration is the same as that for the ground state, **
*^{158}Tm^{m} I : p7/2[404] n3/2[521], but K=5-. 75Ag01 also cannot rule out the **
*^{158}Tm^{m} I : existence of two ε-decaying states **
*^{158}Ta T : average 97Da07=72(12) 96Pa01=46(4); Birge ratio B=2.06 **
*^{158}Ta^{m} T : average 97Da07=37.7(1.5) 96Pa01=35(1) 79Ho10=36.8(1.6) **
*^{158}Ta^{n} E : from Ensdf2017=2664.5(0.4) keV above ^{158}Ta^{m} **
*^{158}W T : average 19Hi06=1.9(+1.2-0.6) 00Ma95=1.5(0.2) 96Pa01=0.9(+0.4-0.3) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{159}Ce	−31340#	500#							1/2$^-$#					β^- ?;β^-n ?	
^{159}Pr	−40770#	400#				134	ms	43	3/2$^-$#	17	17Wu04	TD	2017	β^-=100;β^-n ?	
^{159}Nd	−49724	30				500	ms	30	7/2$^+$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	*
^{159}Pm	−56554	10				1.49	s	0.13	(5/2$^-$)	12	17Wu04	T	1998	β^-=100	*
^{159}Pm^{m}	−55089	10	1465.0	0.5		4.42	μs	0.17	17/2$^+$#		15YoZX	ETD	2015	IT=100	*
^{159}Sm	−62208	6				11.37	s	0.15	5/2$^-$	12			1986	β^-=100	
^{159}Sm^{m}	−60932	6	1276.5	0.8		116	ns	8	(15/2$^+$)	12	17Pa25	EJ	2009	IT=100	*
^{159}Eu	−66043	4				18.1	m	0.1	5/2$^+$*	12			1961	β^-=100	*
^{159}Gd	−68561.9	1.0				18.479	h	0.004	3/2$^-$*	12			1949	β^-=100	
^{159}Tb	−69532.6	1.1				STABLE			3/2$^+$*	12	12Vi10	J	1933	IS=100	
^{159}Dy	−69167.2	1.4				144.4	d	0.2	3/2$^-$*	12			1951	ε=100	
^{159}Dy^{m}	−68814.4	1.4	352.77	0.14		122	μs	3	11/2$^-$	12			1965	IT=100	
^{159}Ho	−67330	3				33.05	m	0.11	7/2$^-$*	12			1958	β^+=100	
^{159}Ho^{m}	−67124	3	205.91	0.05		8.30	s	0.08	1/2$^+$	12			1966	IT=100	
^{159}Er	−64561	4				36	m	1	3/2$^-$*	12			1962	β^+=100	
^{159}Er^{m}	−64378	4	182.602	0.024		337	ns	14	9/2$^+$	12			1971	IT=100	
^{159}Er^{n}	−64132	4	429.05	0.03		590	ns	60	11/2$^-$	12			1971	IT=100	
^{159}Tm	−60570	28				9.13	m	0.16	5/2$^+$*	12			1971	β^+=100	
^{159}Yb	−55834	18				1.67	m	0.09	5/2$^-$*	12			1975	β^+=100	
^{159}Lu	−49710	40			*	12.1	s	1.0	1/2$^+$	12	FGK12a	J	1980	β^+≈100;α= ?	*
^{159}Lu^{m}	−49610#	90#	100#	80#	*	10#	s		11/2$^-$#					β^+ ?;IT ?;α ?	
^{159}Hf	−42853	17				5.20	s	0.10	7/2$^-$	12	96Pa01	T	1973	β^+=65 7;α=35 7	
^{159}Ta	−34439	20				1.04	s	0.09	1/2$^+$	12	97Da07	T	1979	β^+=66 5;α=34 5	*
^{159}Ta^{m}	−34375	19	64	5	AD	560	ms	60	11/2$^-$	12			1994	α=55 1;β^+=45 1	
^{159}W	−25430#	300#				8.2	ms	0.7	7/2$^-$#	12	96Pa01	TD	1981	α≈100;β^+ ?	*
^{159}Re	−14810#	310#				40#	μs		1/2$^+$#				2006	p ?;α ?	
^{159}Re^{m}	−14600#	300#	210#	50#		20	μs	4	11/2$^-$	12	07Pa27	TD	2006	p=92.5 35;α=7.5 35	*

*^{159}Nd T : symmetrized from 17Wu04=485(+39-20) **
*^{159}Pm T : average 17Wu04=1.48(0.18) 05Ic02=1.5(0.2), supersedes 01AsZY **
*^{159}Pm^{m} J : 99.6-keV gamma to (15/2-), conf=p5/2[532] n(5/2[523],7/2[633]), K=17/2+ **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{159}Sm^m	E : average 17Pa25=1275.9(1.4) 09Ur04=1276.8(1.0)														**
*^{159}Sm^m	T : from 09Ur04; other 17Pa25=50(17)														**
*^{159}Eu	J : 90Al34=5/2														**
*^{159}Lu	J : favored α decay from ^{163}Ta (J=1/2+)														**
*^{159}Ta	T : average 97Da07=0.83(0.18) 96Pa01=1.10(0.10)														**
*^{159}W	T : others 19Hi06=10.3(+2.1-1.5) 81Ho10=7.3(2.7)														**
*^{159}Re^m	T : average 07Pa27=16(9) 06Jo10=21(4)														**
^{160}Pr	−36200#	400#				170	ms	140	1$^+$#	17	17Wu04	TD	2017	β^-=100;β^-n ?	
^{160}Nd	−46720	50				439	ms	37	0$^+$	17	17Wu04	TD	1985	β^-=100;β^-n ?	
^{160}Nd^m	−45610	50	1107.9	0.9		1.63	μs	0.21	(4$^-$)	17	16Id02	ETJ	2016	IT=100	
^{160}Pm	−52894.6	2.0				725	ms	57	6$^-$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	*
^{160}Pm^m	−52704	11	191	11	MD	> 700	ms		1$^-$#		20Or03	EJT	2020	β^- ?; IT ?;β^-n ?	
^{160}Sm	−60233.2	2.0				9.6	s	0.3	0$^+$	05			1986	β^-=100	
^{160}Sm^m	−58871.9	2.0	1361.3	0.4		120	ns	46	(5$^-$)		09Si21	ETJ	2009	IT=100	
^{160}Sm^n	−57475.9	2.0	2757.3	0.4		1.8	μs	0.4	(11$^+$)		16Pa01	ETJ	2016	IT=100	
^{160}Eu	−63493.4	0.9				42.6	s	0.5	(5$^-$)	05	18Ha19	TJ	1973	β^-=100	
^{160}Eu^m	−63400.4	0.8	93.0	1.2	MD	30.8	s	0.5	(1$^-$)	05	18Ha19	ETJ	2016	β^-=100	
^{160}Gd	−67942.1	1.1				STABLE		>31Ey	0$^+$	05	01Da22	T	1933	IS=21.86 3;2β^- ?	*
^{160}Tb	−67836.5	1.1				72.3	d	0.2	3$^-$*	05			1943	β^-=100	
^{160}Dy	−69672.4	0.7				STABLE			0$^+$	05			1938	IS=2.329 18	
^{160}Ho	−66382	15				25.6	m	0.3	5$^+$*	05			1950	β^+=100	
^{160}Ho^m	−66322	15	59.98	0.03		5.02	h	0.05	2$^-$*	05			1955	IT=73 3;β^+=27 3	
^{160}Ho^n	−66185	22	197	16		∼ 3	s		(9$^+$)	05	88Bh05	TD	1988	IT=100	*
^{160}Er	−66064	24				28.58	h	0.09	0$^+$	05			1954	ε=100	
^{160}Tm	−60300	30				9.4	m	0.3	1$^-$*	05			1970	β^+=100	
^{160}Tm^m	−60230	30	67	14		74.5	s	1.5	(5$^+$)	05			1983	IT=85 5;β^+=15 5	*
^{160}Tm^n	−60090#	60#	215#	52#		∼ 200	ns		(8)	05			1986	IT=100	*
^{160}Yb	−58163	5				4.8	m	0.2	0$^+$	05			1967	β^+=100	
^{160}Lu	−50270	60			*	36.1	s	0.3	2$^-$#	05			1979	β^+=100;α ?	
^{160}Lu^m	−50270#	120#	0#	100#	*	40	s	1		05			1980	$\beta^+\approx$100;α ?	
^{160}Hf	−45939	10				13.6	s	0.2	0$^+$	05			1973	β^+=99.3 2;α=0.7 2	
^{160}Ta	−35820	50			*&	1.70	s	0.20	(2)$^-$	05	96Pa01	TD	1979	β^+ ?;α=?	*
^{160}Ta^m	−35710	240	110	250	*&	1.55	s	0.04	(9,10)$^+$	05	96Pa01	TD	1979	β^+ ?;α=?	*
^{160}W	−29330	150				90	ms	5	0$^+$	05	96Pa01	TD	1979	α=87 8;β^+ ?	*
^{160}Re	−16880#	300#				611	μs	7	(4$^-$)	05	11Da12	TJD	1992	p=89 1;α=11 1	*
^{160}Re^m	−16700#	300#	177	15		2.8	μs	0.1	(9$^+$)		11Da01	JT	2011	IT=100	
*^{160}Pm	T : the value of 17Wu04 probably includes both the gs and isomer														**
*^{160}Gd	T : value quoted at 68% CL														**
*^{160}Ho^n	E : from 169.61 keV + x with x<55 keV from Ensdf2005														**
*^{160}Tm^m	E : from 42.10+x keV above gs; x<50 keV from Ensdf2005														**
*^{160}Tm^n	E : 98.2 keV+x keV above ^{160}Tm^m; x=50#(50#) keV by Nubase														**
*^{160}Ta	J : favored α decay to ^{156}Lu [J=(2)-]														**
*^{160}Ta^m	J : favored α decay to ^{156}Lu^m [J=10+]														**
*^{160}W	T : average 96Pa01=91(5) 81Ho10=81(15)														**
*^{160}Re	J : other 92Pa05=(2-)														**
^{161}Pr	−32490#	500#				90#	ms	>550ns	3/2$^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{161}Nd	−42230#	400#				215	ms	76	1/2$^-$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{161}Pm	−50087	9				1.05	s	0.15	(5/2$^-$)	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{161}Pm^m	−49121	9	965.9	0.9		0.89	μs	0.09	(13/2$^+$)	17	15YoZX	TJ	2015	IT=100	
^{161}Sm	−56672	7				4.8	s	0.4	7/2$^+$#	11			1998	β^-=100	
^{161}Sm^m	−55284	7	1388.1	0.6		2.6	μs	0.4	(17/2$^-$)		17Pa25	ETJ	2017	IT=100	
^{161}Eu	−61792	10				26.2	s	2.3	5/2$^+$#	11	17Wu04	T	1986	β^-=100	*
^{161}Gd	−65506.1	1.5				3.646	m	0.003	5/2$^-$	11	94It.A	T	1949	β^-=100	
^{161}Tb	−67461.8	1.2				6.948	d	0.005	3/2$^+$*	11	FGK204	T	1949	β^-=100	
^{161}Dy	−68055.5	0.7				STABLE			5/2$^+$*	11			1934	IS=18.889 42	
^{161}Dy^m	−67569.9	0.7	485.56	0.16		760	ns	170	11/2$^-$	11	12Sw01	T	2012	IT=100	
^{161}Ho	−67196.3	2.2				2.48	h	0.05	7/2$^-$*	11			1954	ε=100	
^{161}Ho^m	−66985.2	2.2	211.15	0.03		6.76	s	0.07	1/2$^+$	11			1965	IT=100	
^{161}Er	−65201	9				3.21	h	0.03	3/2$^-$*	11			1954	β^+=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{161}Er^{m}	−64805	9	396.44	0.04		7.5	μs	0.7	11/2$^-$	11			1969	IT=100	
^{161}Tm	−61899	28				30.2	m	0.8	7/2$^+$*	11			1959	β^+=100	
^{161}Tm^{m}	−61891	28	7.51	0.24		5#	m		(1/2$^+$)	11			1981	β^+ ?;IT ?	
^{161}Tm^{n}	−61821	28	78.20	0.03		110	ns	3	7/2$^-$	11			1981	IT=100	
^{161}Yb	−57834	15				4.2	m	0.2	3/2$^-$*	11			1974	β^+=100	
^{161}Lu	−52562	28				77	s	2	1/2$^+$*	11			1973	β^+=100	
^{161}Lu^{m}	−52380#	28#	182#	5#		7.3	ms	0.4	(9/2$^-$)	11			1973	IT≈100;β^+ ?	*
^{161}Hf	−46316	23				18.4	s	0.4	(7/2$^-$)	15			1973	β^+=99.71 5;α=0.29 5	
^{161}Hf^{m}	−45987	23	329.0	0.5		4.8	μs	0.2	(13/2$^+$)	15			2014	IT=100	
^{161}Ta	−38779	24			*	3#	s		(1/2$^+$)	11			1979	β^+ ?;α ?	
^{161}Ta^{m}	−38717	12	61	23	AD*	3.08	s	0.11	(11/2$^-$)	11	12Th13	D	1979	β^+=93 3;α=7 3	
^{161}W	−30510#	200#				409	ms	16	7/2$^-$#	11	96Pa01	T	1973	α=73 3;β^+=27 3	*
^{161}Re	−20840	150				440	μs	1	1/2$^+$	11	06La16	T	1979	p≈100;α ?	
^{161}Re^{m}	−20720	150	123.7	1.3	IT	14.7	ms	0.3	11/2$^-$	11			1979	α=93.0 3;p=7.0 3	
^{161}Os	−10200#	400#				640	μs	60	(7/2$^-$)	11			2010	α≈100	

*^{161}Pm^{m} J : from 727.5-keV gamma to (11/2-), 609.2-keV gamma to (13/2-); **
*^{161}Pm^{m} J : conf=p5/2[532] n(1/2[521],7/2[633]), K=13/2+ **
*^{161}Eu T : average 17Wu04=30.1(9.0) 90An31=24(4) 86Ma12=27(3) **
*^{161}Er T : other 16Ba65=3.20(0.09) **
*^{161}Lu^{m} E : 166.5(0.8) keV above the 3/2+ member of the p1/2[411] band at x keV; **
*^{161}Lu^{m} E : x=15#(5#) keV estimated by Nubase **
*^{161}W T : average 96Pa01=409(18) 79Ho10=410(40) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{162}Nd	−39010#	400#				310	ms	200	0$^+$	17	17Wu04	TD	2012	β^-=100	
^{162}Pm	−46040#	300#				630	ms	180	2$^+$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{162}Sm	−54379	4				2.7	s	0.3	0$^+$	07	17Wu04	T	2005	β^-=100	
^{162}Sm^{m}	−53370	4	1009.4	0.5		1.78	μs	0.07	(4$^-$)		17Yo01	ETJ	2017	IT=100	*
^{162}Eu	−58722.9	1.3				∼10	s		1$^+$#	07	17Wu04	T	1987	β^-=100	
^{162}Eu^{m}	−58565.0	1.3	158.0	1.7	MD	15.0	s	0.5	(6$^+$)	07	18Ha19	TJ	2016	β^-=100	
^{162}Gd	−64281	4				8.4	m	0.2	0$^+$	07			1967	β^-=100	
^{162}Tb	−65879.5	2.0				7.60	m	0.15	(1$^-$)	16			1965	β^-=100	
^{162}Tb^{m}	−65594.0	2.5	286	3		10#	m		4$^-$#		20Or03	EJ	2020	β^- ?; IT ?	
^{162}Dy	−68181.2	0.7				STABLE			0$^+$	07			1934	IS=25.475 36	
^{162}Dy^{m}	−65993.1	0.8	2188.1	0.3		8.3	μs	0.3	8$^+$		11Sw02	ETD	2011	IT=100	
^{162}Ho	−66041	3				15.0	m	1.0	1$^+$*	07			1957	β^+=100	
^{162}Ho^{m}	−65935	3	105.87	0.06		67.0	m	0.7	6$^-$*	07			1961	IT=62;β^+=38	
^{162}Er	−66334.2	0.8				STABLE		>140Ty	0$^+$	07	56Po16	T	1938	IS=0.139 5;α ?;2β^+ ?	*
^{162}Er^{m}	−64308.2	0.8	2026.01	0.13		88	ns	16	7(−)	07	12Sw01	TJ	1974	IT=100	
^{162}Tm	−61477	26				21.70	m	0.19	1$^-$*	07			1963	β^+=100	
^{162}Tm^{m}	−61350	50	130	40		24.3	s	1.7	5$^+$	07	74De47	EDJ	1974	IT=81 4;β^+=19 4	*
^{162}Yb	−59821	15				18.87	m	0.19	0$^+$	07			1963	β^+=100	
^{162}Lu	−52830	80			*	1.37	m	0.02	1$^-$*	07			1978	β^+=100	
^{162}Lu^{m}	−52710#	220#	120#	200#	*	1.5	m		4$^-$#	07			1980	β^+≈100;IT ?	
^{162}Lu^{n}	−52530#	220#	300#	200#	EU	1.9	m		9$^-$#	07			1980	β^+ ?;IT ?	*
^{162}Hf	−49168	9				39.4	s	0.9	0$^+$	07			1982	β^+=99.992 1;α=0.008 1	
^{162}Ta	−39780	60			*	3.57	s	0.12	3$^-$#	16			1985	β^+=99.926 10;α=0.074 10	
^{162}Ta^{m}	−39660#	80#	120#	50#	*	5#	s		7$^+$#					β^+ ?;IT ?;α ?	
^{162}W	−33999	18				1.19	s	0.12	0$^+$	16			1973	β^+ ?;α=45.2 16	
^{162}Re	−22450#	200#				107	ms	13	(2)$^-$	07			1979	α=94 6;β^+ ?	
^{162}Re^{m}	−22280#	200#	175	9	AD	77	ms	9	(9)$^+$	07			1979	α=91 5;β^+ ?	
^{162}Os	−14500#	300#				2.1	ms	0.1	0$^+$	07			1989	α=100	

*^{162}Sm^{m} T : other 17Pa25=1.7(0.2) **
*^{162}Eu T : 17Wu04=11.8(1.4) 87Gr12=10.6(1.0) but values include both gs and isomer **
*^{162}Eu J : from 18Ha19; conf p5/2[413]n7/2[633],K=1+ **
*^{162}Er T : the lower limit is for α decay **
*^{162}Tm^{m} E : from 66.90+x keV; x<125 keV from 74De47 **
*^{162}Lu^{n} I : existence is tentative and needs confirmation **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{163}Nd	−34080#	500#				80#	ms	>550ns	5/2$^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{163}Pm	−42960#	400#				255	ms	25	5/2$^-$#	17	19Ki.A	T	2012	β^-=100;β^-n ?	*
^{163}Sm	−50600	7				1.3	s	0.5	1/2$^-$#	17	17Wu04	TD	2012	β^-=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{163}Eu	−56573.8	0.9				7.7	s	0.4	$5/2^+$#	10	08Os02	T	2007	β^-=100	
^{163}Eu^m	−55609.3	1.0	964.5	0.5		911	ns	24	$(13/2^-)$		17Pa25	TJE	2017	IT=100	*
^{163}Gd	−61388.6	0.8				68	s	3	$7/2^+$	10	20Za04	J	1982	β^-=100	
^{163}Gd^m	−61250.4	0.8	138.22	0.20		23.5	s	1.0	$1/2^-$		14Ha38	TD	2014	IT= ?;β^- ?	*
^{163}Tb	−64596	4				19.5	m	0.3	$3/2^+$	10			1966	β^-=100	
^{163}Dy	−66380.9	0.7				STABLE			$5/2^-$*	10			1934	IS=24.896 42	
^{163}Ho	−66378.0	0.7				4.570	ky	0.025	$7/2^-$*	10			1957	ε=100	*
^{163}Ho^m	−66080.1	0.7	297.88	0.07		1.09	s	0.03	$1/2^+$	10			1957	IT=100	
^{163}Ho^n	−64268.6	0.8	2109.4	0.4		800	ns	150	$(23/2^+)$		12Sw01	ETJ	2012	IT=100	
^{163}Er	−65167	5				75.0	m	0.4	$5/2^-$*	10			1953	β^+=100	
^{163}Er^m	−64722	5	445.5	0.6		580	ns	100	$(11/2^-)$	10			1974	IT=100	
^{163}Tm	−62728	6				1.810	h	0.005	$1/2^+$*	10			1959	β^+=100	
^{163}Tm^m	−62641	6	86.92	0.05		380	ns	30	$(7/2)^-$	10			1975	IT=100	
^{163}Yb	−59294	15				11.05	m	0.35	$3/2^-$*	10			1967	β^+=100	
^{163}Lu	−54791	28				3.97	m	0.13	$1/2^+$*	10			1979	β^+=100	
^{163}Hf	−49269	26				40.0	s	0.6	$(5/2^-)$	15			1982	β^+=100;α ?	
^{163}Ta	−42530	40				10.6	s	1.8	$1/2^+$	10	FGK12a	J	1985	$\beta^+\approx$100;α ?	*
^{163}Ta^m	−42400#	40#	138#	18#	AD	10#	s		$9/2^-$		FGK12a	J		β^+ ?;α ?;IT ?	*
^{163}W	−34910	60				2.63	s	0.09	$7/2^-$	10			1973	β^+ ?;α=14 2	
^{163}W^m	−34430	60	480.3	0.7		154	ns	3	$13/2^+$	10			2010	IT=100	
^{163}Re	−26002	19				390	ms	70	$1/2^+$	10			1979	β^+ ?;α=32 3	
^{163}Re^m	−25882	19	120	5	AD	214	ms	5	$11/2^-$	10			1979	α=66 4;β^+ ?	
^{163}Os	−16340#	300#				5.7	ms	0.5	$7/2^-$	10	13Dr06	J	1981	$\alpha\approx$100;β^+ ?	*
^{163}Ir	−5310#	400#							$1/2^+$#					p ?	

*^{163}Pm T : other 17Wu04=430(350) **
*^{163}Sm T : symmetrized from 17Wu04=1.23(+0.51-0.47) **
*^{163}Eu^m T : average 17Pa25=990(40) 17Yo01=869(29) **
*^{163}Gd^m J : 20Za04=1/2- **
*^{163}Ho T : other: 92Ju01=47(+5-4) d for q=66+ (bare ion) **
*^{163}Ta J : favored α decay from ^{167}Re^m (J=1/2+) **
*^{163}Ta^m J : favored α decay from ^{167}Re (J=9/2-) **
*^{163}Os T : average 19Hi06=6.2(+1.3–0.9) 96Bi07=5.5(0.6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{164}Pm	−38360#	400#				300#	ms	>550ns	5^-#		18Fu08	I	2018	β^- ?;β^-n ?	
^{164}Sm	−47925	4				1.43	s	0.24	0^+	17			2012	β^-=100;β^-n ?	
^{164}Sm^m	−46440	4	1485.5	1.2		600	ns	140	(6^-)	17			2014	IT=100	
^{164}Eu	−53232.1	2.1				4.16	s	0.19	3^-#	17	17Wu04	T	2007	β^-=100	
^{164}Gd	−59693.7	1.0				45	s	3	0^+	17			1988	β^-=100	
^{164}Gd^m	−58597.9	1.1	1095.8	0.4		589	ns	18	(4^-)	17	18Ga18	T	2017	IT=100	*
^{164}Tb	−62105.0	1.9				3.0	m	0.1	(5^+)	17			1968	β^-=100	
^{164}Tb^m	−61960	12	145	12	MD	2#	m		2^+#		20Or03	EJ	2020	β^- ?; IT ?	
^{164}Dy	−65967.6	0.7				STABLE			0^+	17			1934	IS=28.260 54	
^{164}Ho	−64980.5	1.4				28.8	m	0.5	1^+*	17			1938	ε=61 1;β^+=39 1	
^{164}Ho^m	−64840.7	1.4	139.78	0.07		36.6	m	0.3	6^-*	17			1966	IT=100	
^{164}Er	−65942.6	0.7				STABLE			0^+	17			1938	IS=1.601 3;α ?;2β^+ ?	
^{164}Tm	−61909	25				2.0	m	0.1	1^+*	17			1960	β^+=100;ε=61 1;e$^+$=39 1	
^{164}Tm^m	−61889	28	20	12		5.1	m	0.1	6^-*	17			1971	IT$\approx$80;$\beta^+\approx$20	*
^{164}Yb	−61012	15				75.8	m	1.7	0^+	17			1960	ε=100	
^{164}Lu	−54642	28				3.14	m	0.03	1^-*	17			1977	β^+=100	
^{164}Hf	−51818	16				111	s	8	0^+	17			1981	β^+=100	
^{164}Ta	−43283	28				14.2	s	0.3	(3^+)	17			1982	β^+=100	
^{164}W	−38236	10				6.3	s	0.2	0^+	17			1973	β^+=96.2 12;α=3.8 12	
^{164}Re	−27470	50			*	719	ms	89	$(2)^-$	17			1979	α=?;β^+ ?	*
^{164}Re^m	−27520	240	−50	250	*	890	ms	130	$(9,10)^+$	17	09Ha42	TD	2009	β^+ ?;α=3 1	*
^{164}Os	−20420	150				21	ms	1	0^+	17			1981	α=96 4;β^+ ?	
^{164}Ir	−7480#	320#				1#	ms		2^-#	17				p ?;α ?;β^+ ?	
^{164}Ir^m	−7220#	300#	260#	100#		70	μs	10	(9^+)	17	14Dr02	TD	2001	p=?;α=4 2;β^+ ?	*

*^{164}Eu T : average 17Wu04=3.80(0.56) 08Os02=4.2(0.2) **
*^{164}Gd^m T : average 18Ga18=605(30) 17Yo01=580(23); other 17Pa25=530(100) **
*^{164}Tm^m E : from 87Dr07<40 keV **
*^{164}Re T : average 09Ha42=848(+140-105) 96Pa01=380(160) 81Ho10=880(240) **
*^{164}Re J : favored α decay to ^{160}Ta [J=(2)-] **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{164}Re^m	T : symmetrized from 09Ha42=864(+150-110)													**
*^{164}Re^m	J : favored α decay to ^{160}Ta^m [J=(9,10)+]													**
*^{164}Ir^m	T : from p(t) in 14Dr02; others 14Dr02=69(+41-29) (α(t))													**
*^{164}Ir^m	T : 02Ma61=58(+46-18) 01Ke05=110(+60-30)													**
^{165}Pm	−34670#	500#				260# ms	>550ns	$5/2^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{165}Sm	−43510#	400#				980 ms	210	$5/2^-$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{165}Eu	−50729	5				2.53 s	0.25	$5/2^+$#	08	17Wu04	T	2007	β^-=100;β^-n ?	*
^{165}Gd	−56525.8	1.3				11.6 s	1.0	$1/2^-$#	06	17Wu04	T	1998	β^-=100	*
^{165}Tb	−60588.8	1.5				2.11 m	0.10	$(3/2^+)$	06			1983	β^-=100	
^{165}Tb^m	−60382	5	207	5		0.81 μs	0.08	$(7/2^-)$		17Gu08	TDE	2017	IT=100	
^{165}Dy	−63612.3	0.7				2.332 h	0.004	$7/2^+$*	20			1935	β^-=100	
^{165}Dy^m	−63504.1	0.7	108.1552	0.0013		1.257 m	0.006	$1/2^-$	06			1963	IT=97.76 11;β^-=2.24 11	
^{165}Ho	−64898.0	0.8				STABLE		$7/2^-$*	06			1934	IS=100	
^{165}Ho^m	−64536.3	0.8	361.675	0.011		1.512 μs	0.004	$3/2^+$	06			1958	IT=100	
^{165}Ho^n	−64182.7	0.8	715.33	0.02		< 100 ns		$7/2^+$	06			1958	IT=100	
^{165}Er	−64521.4	0.9				10.36 h	0.04	$5/2^-$*	06			1950	ε=100	
^{165}Er^m	−63970.1	1.1	551.3	0.6		250 ns	30	$11/2^-$	06			1970	IT=100	
^{165}Er^n	−62698.4	1.1	1823.0	0.6		370 ns	40	(19/2)		12Sw01	EJT	2012	IT=100	
^{165}Tm	−62930.0	1.7				30.06 h	0.03	$1/2^+$*	06			1953	β^+=100	
^{165}Tm^m	−62849.6	1.7	80.37	0.06		80 μs	3	$7/2^+$	06			1967	IT=100	
^{165}Tm^n	−62769.5	1.7	160.47	0.06		9.0 μs	0.5	$7/2^-$	06			1968	IT=100	
^{165}Yb	−60295	27				9.9 m	0.3	$5/2^-$*	06			1964	β^+=100	
^{165}Yb^m	−60168	27	126.80	0.09		300 ns	30	$9/2^+$	06			1980	IT=100	
^{165}Lu	−56442	27				10.74 m	0.10	$1/2^+$*	06			1973	β^+=100	
^{165}Hf	−51636	28				76 s	4	$(5/2^-)$	06			1981	β^+=100	
^{165}Ta	−45848	14			*	31.0 s	1.5	$(1/2^+,3/2^+)$	06	FGK12a	J	1982	β^+=100	*
^{165}Ta^m	−45823	17	24	18	AD*	30# s		$(9/2^-)$		FGK12a	J		β^+ ?;α ?	*
^{165}W	−38861	26				5.1 s	0.5	$(5/2^-)$	06			1975	β^+=100;α ?	
^{165}Re	−30659	24			*	1.6 s	0.6	$(1/2^+)$	15			1981	β^+=86 8;α=14 8	
^{165}Re^m	−30632	12	28	22	AD*	1.74 s	0.06	$(11/2^-)$	15			1978	β^+=87 1;α=13 1	
^{165}Os	−21750#	200#				71 ms	3	$(7/2^-)$	14			1978	α=90 2;β^+=10 2	
^{165}Ir	−11600#	160#				50# ns		$1/2^+$#	06				p ?;α ?	
^{165}Ir^m	−11420	150	180#	50#		325 μs	33	$(11/2^-)$	06	14Dr02	TD	1997	p=88 2;α=12 2	*
^{165}Pt	−320#	400#				370 μs	180	$7/2^-$#		19Hi06	T	2019	α=100	*
*^{165}Eu	T : average 17Wu04=2.14(0.45) 08Os02=2.7(0.3)													**
*^{165}Gd	T : average 17Wu04=12.5(1.3) 98Ic02=9.3(2.3) and 11.2(2.3)													**
*^{165}Ta	J : favored α decay from ^{169}Re^m [J=(1/2+,3/2+)]													**
*^{165}Ta^m	J : favored α decay from ^{169}Re [J=(9/2-)]													**
*^{165}Ir^m	T : average 14Dr02=340(40) 97Da07=290(60)													**
*^{165}Pt	T : symmetrized from 19Hi06=260(+260–90)													**
^{166}Sm	−40450#	400#				800 ms	630	0^+	17	17Wu04	TD	2017	β^-=100	
^{166}Eu	−46750#	100#				1.24 s	0.12	0^-#	14	17Wu04	T	2007	β^-=100;β^-n ?	*
^{166}Gd	−54370.9	1.6				5.1 s	0.8	0^+	15	17Wu04	T	2005	β^-=100	*
^{166}Gd^m	−52769.4	1.9	1601.5	1.1		950 ns	60	(6^-)	15			2014	IT=100	
^{166}Tb	−57808.8	1.5				27.1 s	1.5	(1^-)	08	17Wu04	T	1996	β^-=100	*
^{166}Tb^m	−57649.8	2.1	159.0	1.5		3.5 μs	0.4	4^-#		17GuZW	EJT	2017	IT=100	
^{166}Dy	−62584.5	0.8				81.6 h	0.1	0^+	08			1949	β^-=100	
^{166}Ho	−63070.3	0.8				26.812 h	0.007	0^-*	08	FGK204	T	1936	β^-=100	
^{166}Ho^m	−63064.3	0.8	5.969	0.012		1.1326 ky	0.0039	7^-	08	18Pe02	T	1952	β^-=100	
^{166}Ho^n	−62879.4	0.8	190.9021	0.0020		185 μs	15	3^+	08			1960	IT=100	
^{166}Er	−64924.1	0.3				STABLE		0^+	08			1934	IS=33.503 36	
^{166}Tm	−61886	12				7.70 h	0.03	2^+*	08			1948	β^+=100	
^{166}Tm^m	−61764	14	122	7		348 ms	21	(6^-)	08	96Dr07	TDJ	1996	IT=100	*
^{166}Tm^n	−61642	14	244	7		2 μs	1	(6^-)	08	96Dr07	EDT	1995	IT=100	*
^{166}Yb	−61594	7				56.7 h	0.1	0^+	08			1954	ε=100	
^{166}Lu	−56021	30				2.65 m	0.10	6^-*	08			1969	β^+=100	
^{166}Lu^m	−55990	30	34.37	0.22		1.41 m	0.10	3^-*	08			1974	β^+=58 5;IT=42 5	
^{166}Lu^n	−55980	30	43.0	0.4		2.12 m	0.10	0^-*	08			1974	β^+=90 6;IT ?	*
^{166}Hf	−53859	28				6.77 m	0.30	0^+	08			1965	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{166}Ta	−46098	28				34.4 s	0.5	(2)$^+$	08			1977	β^+=100	
^{166}W	−41887	9				19.2 s	0.6	0$^+$	08			1975	β^+=99.965 12;α=0.035 12	
^{166}Re	−31840	90				2.25 s	0.21	(7$^+$)	08	92Me10	J	1978	β^+=88 7;α=12 7	*
^{166}Re^p	−31560#	100#	280#	50#		3# s		3$^-$#	08				β^+ ?;α ?;IT ?	
^{166}Os	−25432	18				213 ms	5	0$^+$	16	08Bi15	D	1977	α=83 4;β^+=17 4	*
^{166}Ir	−13310#	200#				10.5 ms	2.2	(2)$^-$	08			1981	α=93 3;p=7 3	
^{166}Ir^m	−13130#	200#	171	6	p	15.1 ms	0.9	(9)$^+$	08			1996	α=98.2 6;p=1.8 6	
^{166}Pt	−4780#	300#				294 μs	62	0$^+$	08	19Hi06	T	1996	α=100	*

*^{166}Eu T : symmetrized from 17Wu04=1.27(+0.09-0.14); other 08Os02=1.7(0.3) **
*^{166}Gd T : average 17Wu04=5.4(1.2) 05Ic02=00As.A=4.8(1.0) **
*^{166}Tb T : average 17Wu04=28.3(2.0) 05Ic02=00As.A=25.6(2.2) **
*^{166}Tm^m E : from 96Dr07=109.3+x keV with x<25 keV **
*^{166}Tm^m T : average 96Dr07=340(25) (34.4(t)) 370(40) (74.9(t)) **
*^{166}Tm^n E : 96Dr07=121.710 keV above ^{166}Tm^m **
*^{166}Tm^n T : other 02Ca46=36(2) ns (adopted in Ensdf2008) **
*^{166}Lu^n D : %β^+ from 74De09>80% **
*^{166}Re D : β^+ and α decays were observed; %α from Ensdf2008<24 **
*^{166}Os D : %α average 08Bi15=84(4) 81Ho10=72(13) **
*^{166}Pt T : average 19Hi06=260(+100-60) 96Bi07=300(100) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{167}Sm	−35330#	500#				190# ms	>550ns	7/2$^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{167}Eu	−43770#	400#				1.33 s	0.51	5/2$^+$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{167}Gd	−50776	5				4.2 s	0.3	5/2$^-$#	17	17Wu04	TD	2012	β^-=100	*
^{167}Tb	−55883.1	1.9				18.9 s	1.6	(3/2$^+$)	00	17Wu04	T	1999	β^-=100	*
^{167}Tb^m	−55683	6	200	6		1.2 μs	0.1	(7/2$^-$)		17Gu08	TEJ	2017	IT=100	
^{167}Dy	−59911	4				6.20 m	0.08	(1/2$^-$)	00			1960	β^-=100	
^{167}Ho	−62279	5				3.1 h	0.1	7/2$^-$	00			1955	β^-=100	
^{167}Ho^m	−62020	5	259.34	0.11		6.0 μs	1.0	3/2$^+$	00			1977	IT=100	
^{167}Er	−63289.26	0.29				STABLE		7/2$^+$*	00			1934	IS=22.869 9	
^{167}Er^m	−63081.46	0.29	207.801	0.005		2.269 s	0.006	1/2$^-$	00			1986	IT=100	
^{167}Tm	−62543.1	1.3				9.25 d	0.02	1/2$^+$*	00			1948	ε=100	
^{167}Tm^m	−62363.6	1.3	179.480	0.019		1.16 μs	0.06	7/2$^+$	00			1964	IT=100	*
^{167}Tm^n	−62250.3	1.3	292.820	0.020		0.9 μs	0.1	7/2$^-$	00			1965	IT=100	
^{167}Yb	−60590	4				17.5 m	0.2	5/2$^-$*	00			1954	β^+=100	
^{167}Yb^m	−60018	4	571.548	0.022		∼ 180 ns		11/2$^-$	00			1976	IT=100	*
^{167}Lu	−57530	40				51.5 m	1.0	7/2$^+$*	06			1958	β^+=100	
^{167}Lu^m	−57480#	60#	50#	40#		> 1 m		1/2$^+$*	06			1998	IT ?;β^+ ?	
^{167}Hf	−53468	28				2.05 m	0.05	(5/2)$^-$	00			1969	β^+=100	
^{167}Ta	−48351	28				1.33 m	0.07	(3/2$^+$)	00			1982	β^+=100	
^{167}W	−42093	19				19.9 s	0.5	(5/2$^-$)	00			1985	β^+=99.96 1;α=0.04 1	*
^{167}W^m	−41967	19	125.7	2.2		> 1# μs		(13/2$^+$)		92Th06	EJI		IT ?;β^+ ?	*
^{167}Re	−34830#	40#				3.4 s	0.4	9/2$^-$	00	10An01	J	1992	$\alpha\approx$100;β^+=?	
^{167}Re^m	−34700	40	131#	13#		5.9 s	0.3	1/2$^+$	00	11Ko.B	EJ	1984	β^+ ?;α=?	
^{167}Os	−26500	80				839 ms	5	7/2$^-$	09	10Sc02	TJD	1977	α=51 4;β^+ ?	*
^{167}Os^m	−26070	80	434.3	1.1		672 ns	7	13/2$^+$	09	10Sc02	EJD	2009	IT=100	*
^{167}Ir	−17072	18				29.3 ms	0.6	1/2$^+$	02	05Sc22	TD	1981	α=43.5 19;p=38.6 12;β^+ ?	*
^{167}Ir^m	−16897	18	175.5	2.1	p	28.5 ms	0.5	11/2$^-$	02	05Sc22	TD	1995	α=89 3;β^+ ?;p=0.41 6	*
^{167}Pt	−6750#	310#				915 μs	123	7/2$^-$#	00	19Hi06	T	1996	α=100	*

*^{167}Gd T : symmetrized from 17Wu04=4.26(+0.18-0.32) **
*^{167}Tb T : average 17Wu04=18.6(2.0) 99As03=19.4(2.7) **
*^{167}Tm^m J : E2 transition to 3/2+ **
*^{167}Yb^m J : M1 transition to 9/2- and E1 transition to 13/2+ **
*^{167}W J : population of J=5/2+,7/2+ states in ^{167}Ta following β^+ decay; **
*^{167}W J : favorite α decay to ^{163}Hf [J=(5/2-)] **
*^{167}W^m I : floated J=13/2+ level observed in 92Th06; FGK208=likely E3 to 7/2- **
*^{167}Os D : %α average 10Sc02=51(5) 96Pa01=49(7) 81Ho10=58(12) **
*^{167}Os^m J : 10Sc02=M2 to 9/2- followed by M1 to 7/2- **
*^{167}Os^m E : from a least-squares fit to the level scheme of 10Sc02 **
*^{167}Ir T : from p(t); others 05Sc22=30.9(1.3) (α(t)) 97Da07=35.2(2.0) **
*^{167}Ir D : %p average 05Sc22=39.3(1.3) 97Da07=32(4); %α average **
*^{167}Ir D : 05Sc22=43(2) 97Da07=48(6) **
*^{167}Ir^m T : average 04Ke06=25.7(0.8) 05Sc22=28.7(3.3) (α(t)) and **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{167}Ir^{m} T : 28.8(1.3) (p(t)) 97Da07=30.0(0.6) **
*^{167}Ir^{m} D : %p average 05Sc22=0.42(0.08) 97Da07=0.4(0.1); %α average **
*^{167}Ir^{m} D : 05Sc22=90(3) 97Da07=80(10) **
*^{167}Pt T : average 19Hi06=1100(200) 04Ke06=900(+300-200) 96Bi07=700(200) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{168}Sm	−31640#	300#				340#	ms	>550ns	0^{+}#		18Fu08	I	2018	β^- ?;β^-n ?	
^{168}Eu	−39250#	400#				200	ms	100	6^{-}#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{168}Gd	−48150#	300#				3.03	s	0.16	0^{+}	17	17Wu04	TD	1985	β^-=100	*
^{168}Tb	−52781	4				9.4	s	0.4	(4^{-})	10	17Wu04	T	1999	β^-=100	
^{168}Tb^{m}	−52570	4	211	1		0.71	μs	0.03	(6^{+})		17Gu24	ETJ	2017	IT=100	
^{168}Dy	−58560	140				8.7	m	0.3	0^{+}	10			1982	β^-=100	
^{168}Dy^{m}	−57180	140	1378.2	0.6		0.57	μs	0.7	(4^{-})	10	19Zh49	ETJ	2019	IT=100	
^{168}Ho	−60060	30				2.99	m	0.07	3^{+}	10			1960	β^-=100	
^{168}Ho^{m}	−60000	30	59	1		132	s	4	(6^{+})	10	90Ch37	ETJ	1990	IT$\approx$100;β^- ?	
^{168}Ho^{n}	−59920	30	143.43	0.17		> 4	μs		(1)$^{-}$	10			1990	IT=100	
^{168}Ho^{p}	−59870	30	192.57	0.20		108	ns	11	1^{+}	10			1990	IT=100	
^{168}Er	−62989.23	0.26				STABLE			0^{+}	10			1934	IS=26.978 18	
^{168}Er^{m}	−61895.19	0.26	1094.0383	0.0016		109.0	ns	0.7	4^{-}	10			1974	IT=100	
^{168}Tm	−61312.4	1.7				93.1	d	0.2	3^{+}*	10			1949	$\beta^+\approx$100;β^-=0.010 7	
^{168}Yb	−61579.87	0.09				STABLE		>130Ty	0^{+}	10	56Po16	T	1938	IS=0.123 3;α ?;2β^+ ?	*
^{168}Lu	−57070	40				5.5	m	0.1	6^{-}*	10			1960	β^+=100	
^{168}Lu^{m}	−56908	6	160	40		6.7	m	0.4	3^{+}*	10	99Ba65	E	1960	$\beta^+\approx$100;IT ?	*
^{168}Hf	−55361	28				25.95	m	0.20	0^{+}	10			1961	β^+=100;$\varepsilon\approx$98;e$^+\approx$2	
^{168}Ta	−48394	28				2.0	m	0.1	(3^{+})	10	FGK208	J	1969	β^+=100	*
^{168}W	−44893	13				50.9	s	1.9	0^{+}	10			1971	$\beta^+\approx$100;α=0.0032 10	
^{168}Re	−35790	30				4.4	s	0.1	(7^{+})	10	16Ha36	J	1992	$\beta^+\approx$100;$\alpha\approx$0.005	
^{168}Os	−29995	10				2.1	s	0.1	0^{+}	10			1977	β^+=57 4;α=43 4	
^{168}Ir	−18670	60			*	230	ms	50	(2)$^{-}$	10			1978	$\alpha\approx$100;β^+ ?;β^+p ?	*
^{168}Ir^{m}	−18620	240	40	250	*	163	ms	16	(9,10)$^{+}$	10	09Ha42	TD	1996	α=77 9;β^+ ?;β^+p ?	*
^{168}Pt	−11010	150				2.02	ms	0.10	0^{+}	10			1981	$\alpha\approx$100;β^+ ?	
^{168}Au	2530#	400#												p ?	

*^{168}Gd I : first observed by 85Si25 in fission of ^{252}Cf **
*^{168}Tb T : average 17Wu04=9.49(0.39) 99As03=8.2(1.3) **
*^{168}Yb T : the lower limit is for α decay; **
*^{168}Yb T : 2β^+ 19Be27>0.1 Py to 1 Ey; 0nu-BB 19Be27>1.9 Ey **
*^{168}Lu^{m} E : 19Hu15=160(40) 72Ch44=220(130); others 97Ba26=202.81(0.12) (tentative) **
*^{168}Lu^{m} E : 99Ba65=202.5(0.4) (tentative) **
*^{168}Ta T : other 02At01=5.2(0.7) for q=73+ (bare ion) **
*^{168}Ta J : direct β^+ feeding to 4+ states in ^{168}Hf and expected configuration **
*^{168}Ta J : p1/2[541] (Z=73) n5/2[523] (N=95), K=3+ **
*^{168}Ir T : symmetrized from 09Ha42=222(+60-40) **
*^{168}Ir J : favored α decay to ^{164}Re [J=(2)-] **
*^{168}Ir^{m} T : average 09Ha42=160(+30-20) and 153(+40-30) 96Pa01=161(21) **
*^{168}Ir^{m} J : favored α decay to ^{164}Re^{m} [J=(9,10)+] **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{169}Eu	−35660#	500#				420#	ms	>550ns	5/2^{+}#		18Fu08	I	2018	β^- ?	
^{169}Gd	−43890#	400#				750	ms	210	7/2^{-}#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{169}Tb	−50480#	300#				5.13	s	0.32	3/2^{+}#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{169}Dy	−55600	300				39	s	8	(5/2)$^{-}$	08			1990	β^-=100	*
^{169}Dy^{m}	−55430	300	166.1	0.5		1.26	μs	0.17	(1/2^{-})	08	19Zh49	ETJ	2019	IT=100	
^{169}Ho	−58796	20				4.72	m	0.10	7/2^{-}	08			1963	β^-=100	
^{169}Ho^{m}	−57410	20	1386.2	0.4		118	μs	6	(19/2^{+})		10Dr05	ETJ	2010	IT=100	
^{169}Er	−60921.2	0.3				9.392	d	0.018	1/2^{-}*	08			1956	β^-=100	
^{169}Er^{m}	−60829.2	0.3	92.05	0.10		285	ns	20	(5/2)$^{-}$	08			1969	IT=100	
^{169}Er^{n}	−60677.5	0.3	243.69	0.17		200	ns	10	7/2^{+}	08			1969	IT=100	
^{169}Tm	−61274.7	0.7				STABLE			1/2^{+}*	08			1934	IS=100	
^{169}Tm^{m}	−60958.6	0.7	316.1463	0.0001		659.9	ns	2.3	7/2^{+}	08			1950	IT=100	
^{169}Yb	−60375.53	0.18				32.014	d	0.005	7/2^{+}*	08	FGK209	T	1946	ε=100	
^{169}Yb^{m}	−60351.33	0.18	24.1999	0.0016		46	s	2	1/2^{-}*	08			1949	IT=100	
^{169}Lu	−58083	3				34.06	h	0.05	7/2^{+}*	08			1955	β^+=100	
^{169}Lu^{m}	−58054	3	29.0	0.5		160	s	10	1/2^{-}*	08			1965	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{169}Hf	−54717	28				3.24	m	0.04	(5/2$^-$)	08			1969	β^+=100	
^{169}Ta	−50290	28				4.9	m	0.4	(5/2$^+$)	08	98Zh03	J	1969	β^+=100	
^{169}W	−44918	15				74	s	6	5/2$^-$#	08			1985	β^+=100	
^{169}Re	−38409	11				8.1	s	0.5	(9/2$^-$)	15	92Me10	D	1978	β^+=?;α=0.005 3	*
^{169}Re^m	−38234	13	175	13	AD	15.1	s	1.5	(1/2$^+$,3/2$^+$)	15			1984	β^+ ?;α= ?;IT ?	*
^{169}Os	−30723	26				3.46	s	0.11	(5/2$^-$)	08	96Pa01	T	1972	β^+=86.3 8;α=13.7 8	*
^{169}Ir	−22093	23				353	ms	4	(1/2$^+$)	08	12Th13	D	1978	α=53 7;β^+ ?	*
^{169}Ir^m	−21940	12	153	22	AD	280	ms	1	(11/2$^-$)	08	12Th13	TD	1984	α=79 5;β^+ ?;p ?	*
^{169}Pt	−12460#	200#				6.99	ms	0.09	(7/2$^-$)	08	09Go16	T	1981	α≈100;β^+ ?	*
^{169}Au	−1790#	300#				150#	μs		1/2$^+$#					p ?;α ?;β^+ ?	

*^{169}Dy T : other 17Wu04=78(37) **
*^{169}Re D : %α derived from 92Me10=0.001 - 0.01 **
*^{169}Re J : favored α decay from ^{173}Ir^m [J=11/2-] to (11/2-) level **
*^{169}Re J : at 136.2 keV **
*^{169}Re^m J : favored α decay from ^{173}Ir [J=(1/2+,3/2+)] **
*^{169}Os T : average 96Pa01=3.6(0.2) 95Hi02=3.2(0.3) 84Sc06=3.5(0.2) 82En03=3.4(0.2) **
*^{169}Ir T : other 12Th13=570(30) **
*^{169}Ir D : %α average of 12Th13=57(9) 05Sc22=42(15) 99Po09=50(18) **
*^{169}Ir^m D : %α average 12Th13=78(6) 99Po09=84(8) 96Pa01=72(13); other **
*^{169}Ir^m D : 05Sc22=59(4) at variance, not used **
*^{169}Ir^m T : others 05Sc22,07Sa33=280(3) 99Po09=323(+90-66) 96Pa01=308(22) **
*^{169}Ir^m T : 78Ca11=400(100) 78Sc26=400(200) **
*^{169}Pt T : average 09Go16=6.99(0.10) 04Ke06=7.0(0.2) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{170}Eu	−30860#	500#												β^- ?;β^-n ?	
^{170}Gd	−40850#	500#				420	ms	130	0$^+$	18	17Wu04	TD	2012	β^-=100;β^-n ?	*
^{170}Tb	−46710#	300#				960	ms	78	2$^-$#	18	17Wu04	TD	2012	β^-=100;β^-n ?	*
^{170}Dy	−53710#	200#				54.9	s	8.0	0$^+$	18	17Wu04	TD	2010	β^-=100	
^{170}Dy^m	−52070#	200#	1643.8	0.3		0.99	μs	0.04	(6$^+$)	18			2016	IT=100	
^{170}Ho	−56240	50			*	2.76	m	0.05	(6$^+$)	18			1960	β^-=100	
^{170}Ho^m	−56140	60	100	80	BD*	43	s	2	(1$^+$)	18			1960	β^-=100	
^{170}Er	−60107.5	1.4				STABLE		>410Py	0$^+$	18	18Be25	T	1934	IS=14.910 36;2β^- ?;α ?	
^{170}Tm	−59795.3	0.7				128.6	d	0.3	1$^-$*	18			1936	β^-=99.869 10;ε=0.131 10	
^{170}Tm^m	−59612.1	0.7	183.197	0.004		4.12	μs	0.13	3$^+$	18	96Ho12	J	1967	IT=100	
^{170}Yb	−60763.929	0.010				STABLE			0$^+$	18			1938	IS=2.982 39	
^{170}Yb^m	−59505.47	0.14	1258.46	0.14		370	ns	15	4$^-$	18			1981	IT=100	
^{170}Lu	−57306	17				2.012	d	0.030	0$^+$*	18			1951	β^+=100	
^{170}Lu^m	−57213	17	92.91	0.09		670	ms	100	4$^-$	18			1965	IT=100	*
^{170}Hf	−56254	28				16.01	h	0.13	0$^+$	18			1961	ε=100	
^{170}Ta	−50138	28				6.76	m	0.06	(3$^+$)	18			1969	β^+=100	
^{170}W	−47291	13				2.42	m	0.04	0$^+$	18			1971	β^+=100	
^{170}Re	−38904	11			&	> 1#	s		(8$^-$,9$^-$)#				1974	β^+=100	
^{170}Re^m	−38831	12	73	17	&	9.2	s	0.2	(5$^+$)	18	20Cu04	E	1974	β^+=?;IT ?	*
^{170}Re^n	−38694	11	210.1	0.1		130	ns	10	(6,7,8,9)	18	19Mo.B	ET	1974	IT=100	*
^{170}Os	−33926	10				7.37	s	0.18	0$^+$	18			1972	β^+=90.5 10;α=9.5 10	
^{170}Ir	−23180#	100#			*	910	ms	150	(3$^-$)	18	02Ro17	TD	1977	β^+ ?;α=5.2 17	*
^{170}Ir^m	−23140	90	40#	50#	*	811	ms	18	(8$^+$)	18			1977	α=38 5;β^+ ?;IT ?	
^{170}Pt	−16299	18				13.93	ms	0.16	0$^+$	18	04Ke06	T	1981	α≈100;β^+ ?	*
^{170}Au	−3700#	200#				290	μs	50	(2)$^-$	18	04Ke06	TD	2002	p=89 10;α=11 10	*
^{170}Au^m	−3420#	200#	280	13	p	620	μs	50	(9)$^+$	18	04Ke06	TD	2002	p=58 5;α=42 5	*
^{170}Hg	5420#	300#				310	μs	250	0$^+$		19Hi06	T	2019	α=100	*

*^{170}Gd T : symmetrized from 17Wu04=410(+140-120) **
*^{170}Tb T : other 16So13=910(+180-130) **
*^{170}Lu^m J : M2 to 2+ **
*^{170}Re^m I : introduced in 20Cu04 from Q-value differences between the low-spin **
*^{170}Re^m I : gs and high-spin isomer in α decay of ^{174}Ir **
*^{170}Re^m I : using the 19Mo.B decay scheme **
*^{170}Re^n J : favored α decay from (6,7,8,9) isomer in ^{174}Ir^m **
*^{170}Ir T : symmetrized from 02Ro17=870(+180-120) **
*^{170}Pt T : average 04Ke06=14.0(0.2) 98Ki20=13.5(0.3) 96Bi07=14.7(0.5) **
*^{170}Au T : symmetrized from 04Ke06=286(+50-40) **
*^{170}Au J : favored α decay to ^{166}Re [J=(2)-] **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{170}Au^{m} T : symmetrized from 04Ke06=617(+50-40); other 02Ma61=570(+310-150) **
*^{170}Au^{m} D : %p other 02Ma61=75(15)% **
*^{170}Au^{m} J : favored α decay to ^{166}Re^{m} [J=(9)+] **
*^{170}Hg T : symmetrized from 19Hi06=80(+400–40) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{171}Gd	−36210#	500#				300#	ms	>550ns	$9/2^{+}$#		18Fu08	I	2018	β^{-} ?;β^{-}n ?	
^{171}Tb	−43770#	400#				1.23	s	0.10	$3/2^{+}$#	18	17Wu04	TD	2012	β^{-}=100;β^{-}n ?	*
^{171}Dy	−50010#	200#				4.07	s	0.40	$7/2^{-}$#	18	17Wu04	TD	2012	β^{-}=100	
^{171}Ho	−54520	600				53	s	2	$7/2^{-}$#	18			1989	β^{-}=100	
^{171}Er	−57717.8	1.4				7.516	h	0.002	$5/2^{-}$*	18			1938	β^{-}=100	
^{171}Er^{m}	−57519.2	1.4	198.61	0.09		210	ns	10	$1/2^{-}$	18			1969	IT=100	
^{171}Tm	−59210.3	1.0				1.92	y	0.01	$1/2^{+}$*	18			1948	β^{-}=100	
^{171}Tm^{m}	−58785.3	1.0	424.9557	0.0015		2.60	μs	0.02	$7/2^{-}$	18			1948	IT=100	
^{171}Tm^{n}	−57535.9	1.0	1674.43	0.13		1.7	μs	0.2	$19/2^{+}$	18			2009	IT=100	
^{171}Yb	−59306.818	0.013				STABLE			$1/2^{-}$*	18			1934	IS=14.086 140	
^{171}Yb^{m}	−59211.536	0.013	95.282	0.002		5.25	ms	0.24	$7/2^{+}$	18			1968	IT=100	
^{171}Yb^{n}	−59184.402	0.013	122.416	0.002		265	ns	20	$5/2^{-}$	18			1968	IT=100	
^{171}Lu	−57828.5	1.9				8.247	d	0.023	$7/2^{+}$*	18			1951	β^{+}=100	
^{171}Lu^{m}	−57757.4	1.9	71.13	0.08		79	s	2	$1/2^{-}$*	18			1965	IT=100	
^{171}Hf	−55431	29				12.1	h	0.4	$7/2^{+}$*	18			1951	β^{+}=100	*
^{171}Hf^{m}	−55409	29	21.93	0.09		29.5	s	0.9	$1/2^{-}$*	18			1997	IT≈100;β^{+} ?	
^{171}Ta	−51720	28				23.3	m	0.3	$(5/2^{+})$	18			1969	β^{+}=100	*
^{171}W	−47086	28				2.38	m	0.04	$(5/2^{-})$	18			1983	β^{+}=100	
^{171}Re	−41250	28				15.2	s	0.4	$(9/2^{-})$	18			1987	β^{+}=100	
^{171}Os	−34297	18				8.3	s	0.2	$(5/2^{-})$	18			1972	β^{+} ?;α=1.80 21	
^{171}Ir	−26410	40				3.1	s	0.3	$1/2^{+}$	18	11Ko.B	TJ	1967	β^{+} ?;α=15 2	*
^{171}Ir^{m}	−26250#	40#	164#	11#		1.47	s	0.06	$(11/2^{-})$	18	11Ko.B	T	1967	α=54 5;β^{+} ?;p ?	*
^{171}Pt	−17470	80				45.5	ms	2.5	$7/2^{-}$	18	10Sc02	JD	1981	α=86 3;β^{+} ?	*
^{171}Pt^{m}	−17060	80	412.6	1.0		901	ns	9	$13/2^{+}$	18	FGK128	J	2010	IT=100	*
^{171}Au	−7562	21				22.3	μs	2.4	$1/2^{+}$	18	04Ke06	TJ	1997	p≈100;α ?	*
^{171}Au^{m}	−7308	18	255	10	p	1.036	ms	0.016	$11/2^{-}$	18	04Ke06	TDJ	1996	α=60 6;p=40 6	*
^{171}Hg	3340#	310#				70	μs	30	$3/2^{-}$#	04	04Ke06	TD	2004	α≈100;β^{+} ?	*

*^{171}Tb T : symmetrized from 17Wu04=1.24(+0.09-0.10) **
*^{171}Hf J : 00Ye02=7/2 **
*^{171}Hf J : 00Ye02=1/2 **
*^{171}Ta T : Ensdf18 assign this lifetime to an excited state (Jπ=5/2-) that is **
*^{171}Ta T : 31.2 keV above the proposed ground state (Jπ=5/2+) **
*^{171}Ir T : other 02Ro17=3.2(+1.3-0.7) **
*^{171}Ir D : %α from 13An10=15(2) **
*^{171}Ir^{m} D : %α average 10An01=53(5)% 96Pa01=58(11)% **
*^{171}Ir^{m} T : average 11Ko.B=1.50(0.07) 10An01=1.40(0.10) **
*^{171}Pt D : %α average 10Sc02=83(3) 04GoZZ=96(5) **
*^{171}Pt^{m} J : M2 to 9/2- followed by M1 to 7/2- gs **
*^{171}Au T : average 04Ke06=22(+3-2) 99Po09=17(+9-5) **
*^{171}Au T : other 03Ba20=37(+7-5) conflicting, not used **
*^{171}Au^{m} T : average 04Ke06=1.09(0.03) 03Ba20=1.014(0.019) **
*^{171}Au^{m} D : %p average 04Ke06=34(4) 97Da07=46(4) **
*^{171}Hg T : symmetrized from 04Ke06=59(+36-16) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{172}Gd	−32970#	300#				160#	ms	>550ns	0^{+}#		18Fu08	I	2018	β^{-} ?;β^{-}n ?	
^{172}Tb	−39690#	500#				760	ms	190	6^{+}#	17	17Wu04	TD	2012	β^{-}=100;β^{-}n ?	
^{172}Dy	−47760#	300#				3.4	s	0.2	0^{+}	13	16Wa19	TD	2012	β^{-}=100	
^{172}Dy^{m}	−46480#	300#	1278	1		710	ms	50	(8^{-})		16Wa19	ETJ	2016	β^{-}=19 3;IT=81 3	
^{172}Ho	−51480#	200#				25	s	3	0^{+}#	15			1991	β^{-}=100	*
^{172}Er	−56483	4				49.3	h	0.5	0^{+}	15			1956	β^{-}=100	
^{172}Er^{m}	−54982	4	1500.9	0.3		579	ns	62	(6^{+})	15	10Dr02	ETJ	2006	IT=100	
^{172}Tm	−57374	5				63.6	h	0.3	2^{-}	15			1956	β^{-}=100	
^{172}Tm^{m}	−56898	5	476.2	0.2		132	μs	7	(6^{+})	15			2008	IT=100	
^{172}Yb	−59255.456	0.014				STABLE			0^{+}	95			1934	IS=21.686 130	
^{172}Yb^{m}	−57705.03	0.06	1550.43	0.06		3.6	μs	0.1	6^{-}	95			1969	IT=100	
^{172}Lu	−56736.1	2.3				6.70	d	0.03	4^{-}*	95			1951	β^{+}=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{172}Lu^{m}	−56694.2	2.3	41.86	0.04		3.7 m 0.5	1−∗	95			1962	IT=100;β^+ ?	
^{172}Lu^{n}	−56670.3	2.3	65.79	0.04		332 ns 20	(1)+	95			1965	IT=100	
^{172}Lu^{p}	−56626.7	2.3	109.41	0.10		440 μs 12	(1)+	95			1965	IT=100	
^{172}Lu^{q}	−56522.5	2.3	213.57	0.17		150 ns	(6−)	95			1974	IT=100	
^{172}Hf	−56402	24				1.87 y 0.03	0+	95			1951	ε=100	
^{172}Hf^{m}	−54396	24	2005.84	0.11		163 ns 3	(8−)	95			1976	IT=100	
^{172}Ta	−51330	28				36.8 m 0.3	(3+)	15			1964	β^+=100	
^{172}W	−49097	28				6.6 m 0.9	0+	95			1964	β^+=100	
^{172}Re	−41570	40			*	55 s 5	(2+)	16	FGK208	J	1977	β^+=100	*
^{172}Re^{m}	−41460#	60#	110#	50#	*	15 s 3	(7+)	16	FGK208	J	1972	β^+=100	*
^{172}Os	−37244	13				19.2 s 0.9	0+	95	95Hi02	D	1971	β^+=98.81 17;α=1.19 17	*
^{172}Ir	−27380	30				4.4 s 0.3	(3−,4−)	16			1967	$\beta^+\approx$98;$\alpha\approx$2	
^{172}Ir^{m}	−27240	30	139	10	AD	2.19 s 0.07	(7+)	16			1967	β^+=90.5 11;α=9.5 11	
^{172}Pt	−21107	10				97.6 ms 1.3	0+	10	10An02	D	1981	α=96 3;β^+ ?	*
^{172}Au	−9320	60			*	28 ms 4	(2)−	10			1993	$\alpha\approx$100;p ?;β^+ ?	*
^{172}Au^{m}	−9160	240	160	250	AD*	11.0 ms 1.0	(9,10)+	10	09Ha42	T	1993	$\alpha\approx$100;p ?	*
^{172}Hg	−1060	150				231 μs 9	0+	10			1999	$\alpha\approx$100;β^+ ?	

∗^{172}Ho T : other 17Wu04=27(11) ∗∗
∗^{172}Re J : direct β^+ feeding to 2+; conf=p9/2[514]n5/2[523] (N=97), K=2+ ∗∗
∗^{172}Re^{m} J : direct β^+ feeding to 6+ and 8+; conf=p9/2[514]n5/2[523] (N=97), K=7+ ∗∗
∗^{172}Os D : %α average 04GoZZ=1.4(0.3) 95Hi02=1.1(0.2) ∗∗
∗^{172}Pt D : %α average 10An02=97(3) 04GoZZ=94(6) 99Po09=94(12) ∗∗
∗^{172}Au T : symmetrized from 09Ha42=22(+6-4) ∗∗
∗^{172}Au J : favored α decay to ^{168}Ir [J=(2)-] ∗∗
∗^{172}Au^{m} T : average 09Ha42=9(+2-1) 09Ha42=8(+5-2) (independent measurements); ∗∗
∗^{172}Au^{m} T : others 96Pa01=6.3(1.5) 93Se09=4(1) ∗∗
∗^{172}Au^{m} J : favored α decay to ^{168}Ir^{m} [J=(9,10)+] ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{173}Tb	−36510#	500#				400# ms >550ns	3/2+#		18Fu08	I	2018	β^- ?;β^-n ?	
^{173}Dy	−43740#	400#				1.43 s 0.20	9/2+#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{173}Ho	−49350#	300#				7.1 s 0.4	7/2−#	17	20Li28	TD	2012	β^-=100	*
^{173}Ho^{m}	−48950#	300#	405	1		3.7 μs 1.2	1/2+#	17	20Li28	TD	2020	IT=100	
^{173}Er	−53650#	200#				1.434 m 0.017	(7/2−)	95	94It.A	T	1972	β^-=100	
^{173}Tm	−56256	4				8.24 h 0.08	(1/2+)	95			1961	β^-=100	
^{173}Tm^{m}	−55938	4	317.73	0.20		10.7 μs 1.7	7/2−	95	12Hu10	TJ	1972	IT=100	*
^{173}Tm^{n}	−54350	4	1905.7	0.4		250 ns 69	19/2−	95	12Hu10	ETJ	2012	IT=100	
^{173}Tm^{p}	−52208	4	4047.9	0.5		121 ns 28	35/2−	95	12Hu10	ETJ	2012	IT=100	
^{173}Yb	−57551.234	0.011				STABLE	5/2−∗	95			1934	IS=16.103 63	
^{173}Yb^{m}	−57152.3	0.5	398.9	0.5		2.9 μs 0.1	1/2−	95			1963	IT=100	
^{173}Lu	−56881.0	1.6				1.37 y 0.01	7/2+∗	95			1951	ε=100	
^{173}Lu^{m}	−56757.3	1.6	123.672	0.013		74.2 μs 1.0	5/2−	95			1962	IT=100	
^{173}Hf	−55412	28				23.6 h 0.1	1/2−	06			1951	β^+=100	
^{173}Hf^{m}	−55305	28	107.16	0.05		180 ns 8	5/2−	06			1973	IT=100	
^{173}Hf^{n}	−55215	28	197.47	0.10		160 ns 40	7/2+	06			1973	IT=100	
^{173}Ta	−52397	28				3.14 h 0.13	5/2−	95			1960	β^+=100	
^{173}Ta^{m}	−52224	28	173.10	0.21		205.2 ns 5.6	9/2−	95	95Ca27	E	1977	IT=100	*
^{173}Ta^{n}	−50680	28	1717.2	0.4		132 ns 3	21/2−		06Th07	TJ	2006	IT=100	*
^{173}W	−48727	28				7.6 m 0.2	5/2−	95			1963	β^+=100	
^{173}Re	−43554	28				2.0 m 0.3	(5/2−)	95			1986	β^+=100	
^{173}Os	−37438	15				22.4 s 0.9	5/2−	15			1971	β^+=99.6 2;α=0.4 2	
^{173}Ir	−30268	11				9.0 s 0.8	(1/2+,3/2+)	15	01Ko44	J	1967	β^+=96.5 20;α=3.5 20	*
^{173}Ir^{m}	−30042	11	226	9	AD	2.20 s 0.05	11/2−	15	01Ko44	J	1967	β^+=88 1;α=12 1	*
^{173}Pt	−21940	60				382 ms 2	(5/2−)	15			1966	α=86 4;β^+ ?	
^{173}Au	−12832	23				25.5 ms 0.8	(1/2+)	15	12Th13	T	1983	α=86 13;β^+ ?	*
^{173}Au^{m}	−12618	12	214	21	AD	12.2 ms 0.1	(11/2−)	15	99Po09	D	1984	α=89 11;β^+ ?	*
^{173}Hg	−2660#	200#				800 μs 80	(7/2−)	15			1999	α=100	

∗^{173}Ho T : average 20Li28=7.5(0.7) 17Wu04=6.9(0.5) ∗∗
∗^{173}Tm^{m} T : average 12Hu10=11.1(2.8) 72Pu02=10.4(2.1) ∗∗
∗^{173}Ta^{m} T : average 17Wo02=202(6) 91Ku12=225(15) ∗∗
∗^{173}Ta^{n} T : other 17Wo02=148(9) ∗∗
∗^{173}Ir J : α decay from ^{177}Au (J=1/2+) ∗∗
∗^{173}Ir D : %α from Ensdf2015<7 ∗∗

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{173}Ir^m J : favored α decay from ^{177}Au^m (J=11/2-) **
*^{173}Au T : average 12Th13=26.3(1.2) 99Po09=25(1) **
*^{173}Au D : %α symmetrized from 99Po09=94(+6-19)% **
*^{173}Au^m D : %α symmetrized from 99Po09=92(+8-13)% **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{174}Tb	−31970#	500#				240#	ms	>550ns	2^-#		18Fu08	I	2018	β^- ?;β^-n ?	
^{174}Dy	−41130#	500#				1#	s	>300ns	0^+	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{174}Ho	−45870#	300#				3.7	s	0.4	(8^-)	17	20Li28	JTD	2012	β^-=100	*
^{174}Er	−51950#	300#				3.2	m	0.2	0^+	99			1989	β^-=100	
^{174}Er^m	−50840#	300#	1111.5	0.7		3.9	s	0.3	8^-		17Wu04	T	2006	IT=100	*
^{174}Tm	−53860	40				5.4	m	0.1	4^-	99			1960	β^-=100	*
^{174}Tm^m	−53610	40	252.4	0.7		2.29	s	0.01	0^+		06Ch10	TJD	2006	IT≈100;β^-<1.5	*
^{174}Tm^n	−51770	40	2091.7	0.3		106	μs	7	14^-		13Hu08	EJT	2013	IT=100	
^{174}Yb	−56944.521	0.011				STABLE			0^+	99			1934	IS=32.025 80	
^{174}Yb^m	−55426.373	0.017	1518.148	0.013		830	μs	40	6^+	99			1964	IT=100	
^{174}Yb^n	−55179.3	0.5	1765.2	0.5		256	ns	11	7^-		05Dr05	EJT	2005	IT=100	
^{174}Lu	−55570.3	1.6				3.31	y	0.05	1^-*	99	98Ge13	J	1951	β^+=100	
^{174}Lu^m	−55399.5	1.6	170.83	0.05		142	d	2	6^-*	99	98Ge13	J	1960	IT=99.38 2;ε=0.62 2	
^{174}Lu^n	−55329.5	1.6	240.818	0.004		395	ns	15	3^+	99			1980	IT=100	*
^{174}Lu^p	−55205.1	1.6	365.183	0.006		145	ns	3	4^-	99			1980	IT=100	*
^{174}Lu^q	−53714.6	1.7	1855.7	0.5		194	ns	24	13^+		09Ko19	ETJ	2009	IT=100	
^{174}Lu^r	−51501.9	1.8	4068.4	0.9		97	ns	10	(21^+)		09Ko19	ETJ	2009	IT=100	
^{174}Lu^x	−49720.7	1.8	5849.6	0.9		242	ns	19	(26^-)		09Ko19	ETJ	2009	IT=100	
^{174}Hf	−55844.6	2.3				2.0	Py	0.4	0^+	04			1939	IS=0.16 12;α=100;2β^+ ?	
^{174}Hf^m	−54295.3	2.3	1549.26	0.04		138	ns	4	6^+	04	15Ko14	EJ	1976	IT=100	
^{174}Hf^n	−54047.0	2.3	1797.59	0.07		2.39	μs	0.04	8^-	04	15Ko14	EJ	1974	IT=100	
^{174}Hf^p	−52532.5	2.3	3312.07	0.06		3.7	μs	0.2	14^+	04	15Ko14	EJ	1974	IT=100	
^{174}Ta	−51741	28				1.14	h	0.08	3^+	99			1960	β^+=100	
^{174}W	−50227	28				33.2	m	2.1	0^+	99			1964	β^+=100	
^{174}W^m			*non − exist*		EU	> 187	ns			99			1976	IT=100	*
^{174}W^n			*non − exist*		EU	187	ns	25		99			1976	IT=100	*
^{174}W^p	−47959	28	2267.8	0.4		158	ns	3	8^-		06Ta13	ETJ	2006	IT=100	*
^{174}W^q	−46711	28	3515.6	0.4		128	ns	8	12^+		06Ta13	ETJ	2006	IT=100	*
^{174}Re	−43673	28				2.40	m	0.04	3^+#	99			1972	β^+=100	
^{174}Re^m	−43570#	60#	100#	50#		1#	m	>1us	7^+#		12Gu14	T	2012	IT ?;β^+ ?	
^{174}Os	−39995	10				44	s	4	0^+	99			1971	β^+≈100;α=0.024 7	*
^{174}Ir	−30786	11				7.9	s	0.6	$(2^+,3^-)$	99	20Cu04	J	1967	β^+=99.5 3;α=0.5 3	*
^{174}Ir^m	−30662	11	124	16	AD	4.9	s	0.3	$(6,7,8,9)$	99	20Cu04	JE	1992	β^+=97.5 3;α=2.5 3	
^{174}Pt	−25318	10				862	ms	8	0^+	99	04GoZZ	TD	1966	α=74.9 24;β^+ ?	*
^{174}Au	−14060#	100#				139	ms	3	(3^-)	99	02Ro17	TD	1983	α=90 6;β^+ ?	*
^{174}Au^m	−13930	90	130#	50#		162	ms	2	(9^+)		04GoZZ	DTJ	1995	α=?;β^+ ?	*
^{174}Hg	−6641	19				2.0	ms	0.4	0^+	99	99Se14	T	1997	α≈100;β^+ ?	*

*^{174}Ho T : other 17Wu04=3.2(1.1) **
*^{174}Er^m T : average 17Wu04=3.37(0.73) 09Dr06=4.02(0.35) **
*^{174}Er^m E : from 15Ko14 **
*^{174}Tm J : direct β^- feeding to 5-; conf=p1/2[411] n7/2[514] (N=105), K=4- **
*^{174}Tm^m E : uncertainty estimated by Nubase **
*^{174}Lu^n J : E1 to 2- and 3-, and no gamma to 1- **
*^{174}Lu^p J : E1 to 3+ and 4+ and no gamma to 1- **
*^{174}W^m I : not confirmed in 06Ta13, where the half-life is associated with a **
*^{174}W^m I : different level **
*^{174}W^n I : not confirmed in 06Ta13, where the half-life is associated with a **
*^{174}W^n I : different level **
*^{174}W^p E : derived from a least-squares fit to gamma-ray energies in 15Ko14 **
*^{174}W^q E : derived from a least-squares fit to gamma-ray energies in 15Ko14 **
*^{174}Os D : %α symmetrized from 71Bo06=0.020(+10-4)% **
*^{174}Ir J : favored α decay from ^{178}Au [J=(2+,3-)] in 20Cu04 **
*^{174}Pt T : average 04GoZZ=857(3) 14Pe02=930(30) 96Pa01=890(20) 82En03=900(10); **
*^{174}Pt T : Birge ratio=2.85 **
*^{174}Pt D : %α average 04GoZZ=74(3) 96Pa01=67(6) 79Ha10=83(5) **
*^{174}Au T : others 83Sc24=120(20) 84ScZQ=123(20), 119(26) **
*^{174}Au J : favored alpha decay to ^{170}Ir [J=(3-)] **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{174}Au^m J : non-favored alpha decay to ^{170}Ir^m [J=(8+)] **
*^{174}Au^m T : average 04GoZZ=162(4),171(7) and 163(2) 96Pa01t=171(29) **
*^{174}Hg T : symmetrized from 99Se14=1.9(+0.4-0.3); other 97Uu01=2.1(+1.8-0.7) **

^{175}Dy	−36730#	500#				390#	ms	>550ns	1/2$^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{175}Ho	−43300#	400#				1.88	s	0.55	7/2$^-$#	17	17Wu04	TD	2012	β^-=100;β^-n ?	
^{175}Er	−48650#	400#				1.2	m	0.3	9/2$^+$#	04			1996	β^-=100	
^{175}Tm	−52310	50				15.2	m	0.5	(1/2)$^+$	04			1961	β^-=100	*
^{175}Tm^m	−51870	50	440.0	1.1		319	ns	35	7/2$^-$	04	12Hu10	ETJ	2012	IT=100	
^{175}Tm^n	−50790	50	1517.7	1.2		21	μs	14	23/2$^+$	04	12Hu10	ETJ	2012	IT=100	
^{175}Yb	−54695.56	0.07				4.185	d	0.001	7/2$^-$*	04	12Fl05	J	1945	β^-=100	
^{175}Yb^m	−54180.69	0.07	514.866	0.004		68.2	ms	0.3	1/2$^-$	04			1972	IT=100	
^{175}Lu	−55165.7	1.2				STABLE			7/2$^+$*	04			1934	IS=97.401 13	
^{175}Lu^m	−54812.2	1.2	353.48	0.13		1.49	μs	0.07	5/2$^-$	04			1965	IT=100	
^{175}Lu^n	−53773.3	1.3	1392.4	0.4		984	μs	30	19/2$^+$	04	15Ko14	EJ	1998	IT=100	
^{175}Hf	−54481.8	2.3				70.65	d	0.19	5/2$^-$	04	12Fa07	T	1949	ε=100	
^{175}Hf^m	−54355.9	2.3	125.89	0.12		53.7	μs	1.5	1/2$^-$	04			1964	IT=100	
^{175}Hf^n	−53048.4	2.3	1433.41	0.12		1.10	μs	0.08	19/2$^+$	04	95Gj01	J	1990	IT=100	
^{175}Hf^p	−51466.2	2.3	3015.6	0.4		1.21	μs	0.15	35/2$^-$	04	95Gj01	J	1980	IT=100	
^{175}Hf^q	−49845.6	2.6	4636.2	1.2		1.9	μs	0.1	45/2$^+$	04	04Ko.A	JT	1990	IT=100	
^{175}Ta	−52409	28				10.5	h	0.2	7/2$^+$*	04			1960	β^+=100	
^{175}Ta^m	−52278	28	131.41	0.17		222	ns	8	9/2$^-$	04	96Ko17	JT	1972	IT=100	
^{175}Ta^n	−52070	28	339.2	1.3		170	ns	20	(1/2$^+$)	04			1969	IT=100	
^{175}Ta^p	−50841	28	1567.6	0.3		1.95	μs	0.15	21/2$^-$	04	96Ko17	JT	1996	IT=100	
^{175}W	−49633	28				35.2	m	0.6	(1/2$^-$)	04			1963	β^+=100	
^{175}W^m	−49398	28	234.96	0.15		216	ns	6	(7/2$^+$)	04			1978	IT=100	
^{175}Re	−45288	28				5.89	m	0.05	5/2$^-$#	04			1967	β^+=100	
^{175}Os	−40105	12				1.4	m	0.1	(5/2$^-$)	04			1972	β^+=100	
^{175}Ir	−33395	12				9	s	2	(1/2$^+$)	04	19Gi11	J	1967	β^+=99.15 28;α=0.85 28	*
^{175}Ir^m	−33350#	40#	50#	40#		33	s	4	9/2$^-$#	04	10Wa02	TI	1967	β^+= ?;IT ?	*
^{175}Ir^n	−33298	12	97.4	0.7		6.58	μs	0.15	(5/2$^-$)		19Gi11	ETJ	2019	IT=100	
^{175}Pt	−25709	19				2.43	s	0.04	(7/2$^-$)	04	14Pe02	T	1966	α=64 5;β^+ ?	
^{175}Au	−17400	40				200	ms	3	1/2$^+$	04	17Ba46	T	1975	α=88 4;β^+ ?	*
^{175}Au^m	−17240#	40#	164#	11#	AD	136	ms	1	(11/2$^-$)	04	17Ba46	T	1975	α=75 4;β^+ ?	*
^{175}Hg	−7970	80				10.2	ms	0.3	(7/2$^-$)	09	17Ba46	T	1983	$\alpha\approx$100;β^+ ?	*
^{175}Hg^m	−7480	80	494	2		340	ns	30	(13/2$^+$)	09			2009	IT=100	

*^{175}Tm J : l=0 in (t,α), but cannot distinguish between J=1/2 or 3/2 **
*^{175}Ir T : average 10Wa02=8.8(0.5) 92Sc16=7.2(1.3),11(3) 92Bo21=13(2); other: **
*^{175}Ir T : 67Si02=4.5(1.0) **
*^{175}Ir^m J : from 19Gi11; prolate-deformed p9/2[514] state **
*^{175}Au T : average 17Ba46=200(3) 13An10=207(7) 11Ko.B=188(12) **
*^{175}Au J : favored α decay from ^{179}Tl (J=1/2+) **
*^{175}Au D : %α average 13An10=90(7) 11Ko.B=87(4) **
*^{175}Au^m T : others 11Ko.B=124(8), supersedes 01Ko44=143(8), 10An01=138(5) **
*^{175}Au^m T : 02Ro17=158(3) 96Pa01=185(30) 83Sc24=200(22) for mixture gs and isomer **
*^{175}Au^m J : favored α decay to ^{171}Ir^m [J=(11/2-)] **
*^{175}Au^m D : %α from 11Ko.B=75(4), corrected for %α=64(5) for the **
*^{175}Au^m D : ^{175}Pt daughter **
*^{175}Hg T : average 17Ba46=9.6(0.4) 02Ro17=10.8(0.4) **

^{176}Dy	−33610#	500#				440#	ms	>550ns	0$^+$		18Fu08	I	2018	β^- ?;β^-n ?	
^{176}Ho	−39390#	500#				1#	s	>300ns	4$^+$#	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{176}Er	−46630#	400#				12#	s	>300ns	0$^+$	13	12Ku26	I	2012	β^- ?	
^{176}Tm	−49370	100				1.85	m	0.03	(4$^+$)	06	94It.A	T	1961	β^-=100	
^{176}Yb	−53491.322	0.014				STABLE		>160Py	0$^+$	06	96De60	T	1934	IS=12.995 83;2β^- ?;α ?	
^{176}Yb^m	−52441.5	0.6	1049.8	0.6		11.4	s	0.3	8$^-$*	06			1967	IT=?;β^-<10#	*
^{176}Lu	−53382.3	1.2				37.01	Gy	0.17	7$^-$*	06	06Al03	T	1935	IS=2.599 13;β^-=100; β^+=0.45 26	*
^{176}Lu^m	−53259.5	1.2	122.845	0.004		3.664	h	0.019	1$^-$*	06			1935	$\beta^-\approx$100;ε=0.095 16	
^{176}Lu^n	−51867.8	1.3	1514.5	0.5		312	ns	69	12$^+$	06			2000	IT=100	
^{176}Lu^p	−51794.5	1.3	1587.8	0.6		40	μs	3	14$^+$	06	15Ko14	EJ	2000	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{176}Hf	−54576.4	1.5				STABLE			0^+	06			1934	IS=5.26 70	
^{176}Hf^m	−53243.3	1.5	1333.07	0.07		9.6	μs	0.3	6^+	06			1964	IT=100	
^{176}Hf^n	−53017.1	1.5	1559.31	0.09		9.9	μs	0.2	8^-	06			1967	IT=100	
^{176}Hf^p	−51710.6	1.7	2865.8	0.7		401	μs	6	14^-	06			1975	IT=100	
^{176}Hf^q	−49712.8	1.7	4863.6	0.9		43	μs	4	22^-	06	10Mu13	JT	1976	IT=100	
^{176}Ta	−51370	30				8.09	h	0.05	$(1)^-$	06			1948	β^+=100	
^{176}Ta^m	−51270	30	103.0	1.0		1.08	ms	0.07	7^+	06	78Du06	ET	1971	IT=100	*
^{176}Ta^n	−49900	30	1474.0	1.4		3.8	μs	0.4	14^-	06			1978	IT=100	*
^{176}Ta^p	−48500	30	2874.0	1.4		970	μs	70	20^-	06			1994	IT=100	*
^{176}W	−50642	28				2.5	h	0.1	0^+	06			1950	ε=100	
^{176}Re	−45063	28				5.3	m	0.3	(3^+)	06			1967	β^+=100	
^{176}Os	−42131	11				3.6	m	0.5	0^+	06			1970	β^+=100	
^{176}Ir	−33882	8			*	8.7	s	0.5	(3^+)	06	FGK208	J	1967	β^+=96.9 6;α=3.1 6	*
^{176}Ir^m	−33830#	50#	50#	50#	*	10#	s		(7^+)	06	FGK208	IJ		β^+= ?;IT ?	*
^{176}Pt	−28934	13				6.33	s	0.15	0^+	06			1966	β^+ ?;α=40 2	
^{176}Au	−18520	30			*	1.05	s	0.01	$(3^-,4^-)$	06	14An10	JD	1975	α=75 8;β^+ ?	
^{176}Au^m	−18380	30	139	13	AD*	1.36	s	0.02	$(8^+,9^+)$	06	14An10	DJ	2002	α=?;β^+ ?	*
^{176}Hg	−11785	11				20.3	ms	1.4	0^+	06			1983	α=90 9;β^+ ?	*
^{176}Tl	580	80				6.2	ms	2.3	$(3^-,4^-)$	09	04Ke06	TD	2004	p≈100;α ?;β^+ ?	*

*^{176}Yb^m J : 12Fl05=8 **
*^{176}Lu T : average 37.20(0.23), evaluated by FGK using the world counting data, **
*^{176}Lu T : 06Al03=37.13(0.26), using the world data on age comparison of **
*^{176}Lu T : terrestrial minerals, 06Al03=35.40(0.80), using the world data on **
*^{176}Lu T : age comparison of meteorites **
*^{176}Lu D : %β^+ from 05Am04<0.9 **
*^{176}Ta^m T : average 78Du06=1.05(0.10) 71Go21=1.1(0.1) **
*^{176}Ta^n E : 1371(1) keV above ^{176}Ta^m **
*^{176}Ta^p E : 2771(1) keV above ^{176}Ta^m **
*^{176}Ir J : 205.2-keV gamma, most likely E2, from (1+) state populated by favored **
*^{176}Ir J : α decay from ^{180}Au gs [J=(1+)] **
*^{176}Ir^m J : direct β^+ feeding to J=6 and 7 states in ^{176}Os implies existence **
*^{176}Ir^m J : of a higher-spin β^+ decaying isomer **
*^{176}Au^m T : from 04GoZZ; other 02Ro17=840(+170-140) **
*^{176}Hg D : %α symmetrized from 99Po09=94(+6-12)% **
*^{176}Tl T : symmetrized from 04Ke06=5.2(+3.0-1.4) **
*^{176}Tl J : l_p=0 to ^{175}Hg (J=7/2-) in 04Ke06 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{177}Ho	−36280#	500#				1#	s	>550ns	$7/2^-$#	19	18Fu08	I	2018	β^-=100;n ?	
^{177}Er	−42860#	500#				8#	s	>300ns	$1/2^-$#	19	12Ku26	I	2012	β^- ?	
^{177}Tm	−47570#	200#			*	95	s	7	$1/2^+$#	19			1989	β^-=100	
^{177}Tm^m	−47470#	220#	100#	100#	*	77	s	11	$7/2^-$#	19			1989	β^-=100	
^{177}Yb	−50986.40	0.22				1.911	h	0.003	$9/2^+$*	19			1945	β^-=100	*
^{177}Yb^m	−50654.9	0.4	331.5	0.3		6.41	s	0.02	$1/2^-$*	19			1962	IT=100	*
^{177}Lu	−52383.9	1.2				6.6443	d	0.0009	$7/2^+$*	19			1945	β^-=100	
^{177}Lu^m	−52233.5	1.2	150.3984	0.0010		130.1	ns	2.4	$9/2^-$	19			1949	IT=100	
^{177}Lu^n	−51814.2	1.2	569.6721	0.0015		155	μs	7	$1/2^+$	19			1965	IT=100	
^{177}Lu^p	−51413.7	1.2	970.1757	0.0024		160.4	d	0.3	$23/2^-$*	19			1962	β^-=77.30 8;IT=22.70 8	
^{177}Lu^q	−49612.2	1.3	2771.7	0.5		625	ns	62	$33/2^+$	19			2004	IT=100	
^{177}Lu^r	−48853.5	1.3	3530.4	0.6		6	μs	2	$39/2^-$	19			2003	IT=100	*
^{177}Hf	−52880.7	1.4				STABLE		>1.3Ey	$7/2^-$*	19	20Da04	T	1934	IS=18.60 16	*
^{177}Hf^m	−51565.2	1.4	1315.4502	0.0008		1.09	s	0.05	$23/2^+$	19			1966	IT=100	
^{177}Hf^n	−51538.3	1.7	1342.4	1.0		55.9	μs	1.2	$(19/2^-)$	19			1976	IT=100	
^{177}Hf^p	−50140.7	1.4	2740.02	0.15		51.4	m	0.5	$37/2^-$	19			1971	IT=100	*
^{177}Ta	−51715	3				56.36	h	0.13	$7/2^+$*	19			1948	β^+=100	
^{177}Ta^m	−51642	3	73.16	0.07		410	ns	7	$9/2^-$	19			1973	IT=100	
^{177}Ta^n	−51529	3	186.16	0.06		3.62	μs	0.10	$5/2^-$	19			1971	IT=100	
^{177}Ta^p	−50360	3	1354.8	0.3		5.30	μs	0.11	$21/2^-$	19			1971	IT=100	
^{177}Ta^q	−47059	3	4656.3	0.8		133	μs	4	$49/2^-$	19			1994	IT=100	
^{177}W	−49702	28				132.4	m	2.0	$1/2^-$	19			1950	β^+=100	
^{177}Re	−46269	28				14	m	1	$5/2^-$	19			1957	β^+=100	
^{177}Re^m	−46170#	60#	100#	50#		> 100	ns		$9/2^-$	19				IT=100	
^{177}Re^n	−46184	28	84.70	0.10		50	μs	10	$5/2^+$	19			1972	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{177}Os	−41956	15				3.0	m	0.2	$1/2^-$	19			1970	β^+=100	
^{177}Ir	−36047	20				29.8	s	1.7	$5/2^-$	19			1967	β^+≈100;α=0.06 1	
^{177}Ir^m	−35950#	50#	100#	50#		> 100	ns		$(9/2^-)$	19				IT=100	
^{177}Ir^n	−35866	20	180.9	0.4		> 100	ns		$5/2^+$	19			1991	IT=100	
^{177}Pt	−29370	15				10.0	s	0.4	$5/2^-$	19			1966	β^+=94.3 5;α=5.7 5	
^{177}Pt^m	−29223	15	147.5	0.4		2.35	μs	0.04	$1/2^-$	19	19Gi11	T	1979	IT=100	
^{177}Au	−21546	10				1.501	s	0.020	$1/2^+$*	19			1968	α=40 6;β^+=60 6	*
^{177}Au^m	−21356	10	190	7	AD	1.193	s	0.013	$11/2^-$*	19	20Ba17	J	1975	α=60 10;β^+ ?	
^{177}Hg	−12780	80				117	ms	7	$7/2^-$*	19			1975	α≈100;β^+ ?	*
^{177}Hg^m	−12460	80	323.2	1.3		1.50	μs	0.15	$13/2^+$	19			2003	IT=100	
^{177}Tl	−3340	22				18	ms	5	$(1/2^+)$	19			1999	α=73 13;p ?	
^{177}Tl^m	−2533	12	807	18	p	230	μs	40	$(11/2^-)$	19			1997	p=51 8;α=49 8	

∗^{177}Yb J : 12Fi05=9/2 ∗∗
∗^{177}Yb^m J : 12Fi05=1/2 ∗∗
∗^{177}Lu^r T : other: 04Al04=7(2) m, not trusted ∗∗
∗^{177}Hf J : 95Ji15=7/2 ∗∗
∗^{177}Hf^p T : other 04Al04=76(+16-9) from decay growth ∗∗
∗^{177}Au J : 18Cu04=1/2 ∗∗
∗^{177}Hg J : 19Se04=7/2 ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{178}Ho	−32130#	500#				750#	ms	>550ns	2^+#		18Fu08	I	2018	β^- ?;β^-n ?	
^{178}Er	−40260#	600#				4#	s	>300ns	0^+	13	12Ku26	I	2012	β^- ?	
^{178}Tm	−44240#	300#				10#	s	>300ns	1^-#	11	09St16	I	2008	β^- ?;β^-n ?	
^{178}Yb	−49677	7				74	m	3	0^+	09			1973	β^-=100	
^{178}Lu	−50337.9	2.3				28.4	m	0.2	1^+*	09			1957	β^-=100	
^{178}Lu^m	−50214	3	123.8	2.6	RQ	23.1	m	0.3	9^-*	09			1951	β^-=100	
^{178}Hf	−52435.4	1.4				STABLE			0^+	09			1934	IS=27.28 28	
^{178}Hf^m	−51288.0	1.4	1147.416	0.006		4.0	s	0.2	8^-	09			1960	IT=100	
^{178}Hf^n	−49989.3	1.4	2446.09	0.08		31	y	1	16^+	09			1968	IT=100	
^{178}Hf^p	−49863.0	1.4	2572.4	0.3		68	μs	2	14^-	09			1977	IT=100	
^{178}Ta	−50600#	50#			*	2.36	h	0.08	7^-	09			1950	β^+=100	
^{178}Ta^m	−50498	15	100#	50#	*	9.31	m	0.03	(1^+)	09	96Ko13	E	1950	β^+=100	*
^{178}Ta^n	−49130#	50#	1467.82	0.16		59	ms	3	15^-	09	96Ko13	ETJ	1979	IT=100	*
^{178}Ta^p	−47700#	50#	2901.9	0.7		290	ms	12	21^-	09	96Ko13	ETJ	1996	IT=100	*
^{178}W	−50407	15				21.6	d	0.3	0^+	09			1950	ε=100	
^{178}W^m	−43834	15	6572.7	0.3		220	ns	10	25^+	09			1998	IT=100	
^{178}Re	−45653	28				13.2	m	0.2	(3^+)	09			1957	β^+=100	
^{178}Os	−43544	14				5.0	m	0.4	0^+	09			1967	β^+=100	
^{178}Ir	−36254	19				12	s	2	3^+#	09			1972	β^+=100	
^{178}Pt	−31997	10				20.7	s	0.7	0^+	09			1966	β^+=92.3 3;α=7.7 3	
^{178}Au	−22303	10				3.4	s	0.5	$(2^+,3^-)$*	09	20Cu04	TDJ	1968	β^+=84 1;α=16 1	
^{178}Au^m	−22253	10	50.3	0.2		300	ns	10	$(4^-,5^+)$		19Mo.B	ETD	2019	IT=100	*
^{178}Au^n	−22117	10	186	14	MD	2.7	s	0.5	$(7^+,8^-)$		20Cu04	TDJ	2015	β^+=82 1;α=18 1	*
^{178}Au^p	−22060	17	243	14		390	ns	10	$(5^+,6)$		19Mo.B	ETD	2019	IT=100	*
^{178}Au^q	−21938	24	365	21	AD										
^{178}Hg	−16315	11				266.5	ms	2.4	0^+	09	12Ve04	D	1971	α=89 4;β^+ ?	
^{178}Tl	−4610#	100#				255	ms	9	$(4^-,5^-)$	09	13Li49	TJD	1997	α=62 2;β^+=38 2; β^+SF=0.15 6	*
^{178}Pb	3573	23				250	μs	80	0^+	09	16Ba60	T	2001	α≈100;β^+ ?	*

∗^{178}Ta^m E : K=1+ state (p9/2-[514]+n7/2-[514]) is expected 120 keV above the 7- gs, ∗∗
∗^{178}Ta^m E : based on E=220 keV for K=8+ (p9/2-[514]+n7/2-[514]) and ∗∗
∗^{178}Ta^m E : Gallagher-Moszkowski splitting energy of 100 keV ∗∗
∗^{178}Ta^m J : log ft=4.7 in ^{178}W β^- decay consistent with n7/2[514] -> p9/2[514] ∗∗
∗^{178}Ta^n E : from a least-squares fit to gamma rays in 96Ko13 ∗∗
∗^{178}Ta^n T : average 96Ko13=58(4) 79Du02=60(5) ∗∗
∗^{178}Ta^p E : from a least-squares fit to gamma rays in 96Ko13 ∗∗
∗^{178}Au^m E : 50.3(0.2)-keV E2 above ^{178}Au ∗∗
∗^{178}Au^n E : from 20Cu04 using directly measured masses, supersedes 15Ma.A ∗∗
∗^{178}Au^p E : 56.6(0.4)-keV E2 above ^{178}Au^n ∗∗
∗^{178}Tl T : average 13Li49=252(20) 02Ro17=254(+11-9) ∗∗
∗^{178}Pb T : from τ=266(+184-77), average of four events in 16Ba60 at 365, 127, ∗∗
∗^{178}Pb T : 588 and 166 us and two events in 01Ro.B at 202 and 147 us ∗∗

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{179}Er	−36080#	500#			3#	s	>550ns	$3/2^-$#		18Fu08	I	2018	β^- ?;β^-n ?	
^{179}Tm	−41900#	400#			18#	s	>300ns	$1/2^+$#	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{179}Yb	−46640#	200#			8.0	m	0.4	$(1/2^-)$	09			1982	β^-=100	
^{179}Lu	−49059	5			4.59	h	0.06	$7/2^+*$	09			1961	β^-=100	
^{179}Lu^m	−48467	5	592.4	0.4	3.1	ms	0.9	$1/2^+$	09			1982	IT=100	
^{179}Hf	−50463.0	1.4			STABLE			$9/2^+*$	09			1934	IS=13.62 11	
^{179}Hf^m	−50088.0	1.4	375.0352	0.0025	18.67	s	0.04	$1/2^-$	09			1962	IT=100	
^{179}Hf^n	−49356.6	1.4	1106.412	0.033	25.00	d	0.17	$25/2^-$	09	19Kr06	ET	1970	IT=100	*
^{179}Hf^p	−46687.8	2.5	3775.2	2.1	15	μs	5	$(43/2^+)$	09			2000	IT=100	
^{179}Ta	−50357.5	1.5			1.82	y	0.03	$7/2^+$	09			1950	ε=100	
^{179}Ta^m	−50326.8	1.5	30.7	0.1	1.42	μs	0.08	$9/2^-$	09			1964	IT=100	
^{179}Ta^n	−49837.3	1.5	520.23	0.18	280	ns	80	$1/2^+$	09	FGK128	J	1974	IT=100	
^{179}Ta^p	−49104.9	1.5	1252.60	0.23	322	ns	16	$21/2^-$	09	97Ko13	J	1982	IT=100	
^{179}Ta^q	−49040.3	1.6	1317.2	0.4	9.0	ms	0.2	$25/2^+$	09	97Ko13	J	1982	IT=100	
^{179}Ta^r	−49029.5	1.6	1328.0	0.4	1.6	μs	0.4	$23/2^-$	09	97Ko13	J	1982	IT=100	
^{179}Ta^x	−47718.2	1.6	2639.3	0.5	54.1	ms	1.7	$37/2^+$	09	97Ko13	J	1982	IT=100	
^{179}W	−49295	15			37.05	m	0.16	$7/2^-$	09			1950	β^+=100	
^{179}W^m	−49073	15	221.91	0.03	6.40	m	0.07	$1/2^-$	09			1950	IT≈100;β^+=0.29 4	
^{179}W^n	−47663	15	1631.90	0.08	390	ns	30	$21/2^+$	09	94Wa05	J	1978	IT=100	
^{179}W^p	−45947	15	3348.41	0.14	750	ns	80	$35/2^-$	09	94Wa05	J	1978	IT=100	
^{179}Re	−46584	25			19.5	m	0.1	$5/2^+$	09			1960	β^+=100	
^{179}Re^m	−46519	25	65.35	0.09	95	μs	25	$(5/2^-)$	09			1972	IT=100	
^{179}Re^n	−44760#	60#	1822#	50#	408	ns	12	$(23/2^+)$	09			1972	IT=100	*
^{179}Re^p	−41176	25	5408.0	0.5	466	μs	15	$(47/2,49/2^+)$	09	15Ko14	J	1989	IT=100	
^{179}Os	−43020	16			6.5	m	0.3	$1/2^-$	09			1968	β^+=100	
^{179}Os^m	−42875	16	145.41	0.12	500	ns		$(7/2)^-$	09			1983	IT=100	
^{179}Os^n	−42777	16	243.0	0.8	783	ns	14	$(9/2)^+$	09			1983	IT=100	
^{179}Ir	−38082	10			79	s	1	$(5/2)^-$	09			1992	β^+=100	
^{179}Pt	−32268	8			21.2	s	0.4	$1/2^-$	09			1966	β^+≈100;α=0.24 3	
^{179}Au	−24989	12			7.1	s	0.3	$1/2^+*$	09	18Cu04	J	1968	β^+=78.0 9;α=22.0 9	
^{179}Au^m	−24900	12	89.5	0.3	327	ns	5	$(3/2^-)$		11Ve01	ETD	2011	IT=100	*
^{179}Au^p	−24856	19	133.5	15.0				$(9/2^-)$	09	11Ve01	EJD	1980	IT ?	*
^{179}Hg	−16933	28			1.05	s	0.03	$7/2^-*$	09	12Ve04	D	1970	α=75 4;β^+=25 4;β^+p≈0.15	*
^{179}Hg^m	−16762	28	171.4	0.4	6.4	μs	0.9	$13/2^+$	09	02Je09	J	2002	IT=100	
^{179}Tl	−8270	40			437	ms	9	$1/2^+*$	09			1983	α=60 2;β^+ ?	*
^{179}Tl^m	−7450#	40#	825#	10#	1.41	ms	0.02	$(11/2^-)$	09	18Ba46	TJ	1983	α≈100;IT ?;β^+ ?	*
^{179}Tl^n	−7370	40	904.5	0.9	119	ns	14	$(9/2^-)$	09	18Ba46	TJD	2018	IT=100	*
^{179}Pb	2050	80			2.7	ms	0.2	$(9/2^-)$	10	18Ba46	TJD	2010	α=100	*

*^{179}Hf^n T : average 19Kr06=24.91(0.27) 70KaZV=25.3(0.3) 73Ch18=24.8(0.3). **
*^{179}Hf^n T : other 70Hu04=29(1) **
*^{179}Re^n E : from 1772.20(0.22)+x keV; x=50#(50#) estimated by Nubase **
*^{179}Au^m E : from 19Mo.B **
*^{179}Au^m T : average 19Mo.B=304(9) 11Ve01=328(2); Birge ratio=2.6 **
*^{179}Au^p E : from 44(15) above 89.5 keV level **
*^{179}Hg J : 19Se04=7/2 **
*^{179}Tl T : average 17Ba46=426(10) 11Ko.B=489(21); other 02Ro17=415(55) **
*^{179}Tl T : 13An10t=265(10) 98To14=230(40) 83Sc24=160(+90-40) **
*^{179}Tl J : 17Ba04=1/2; favored α decay to ^{175}Au (J=1/2+) **
*^{179}Tl D : %α from 13An10 **
*^{179}Tl^m J : from favored α decay to ^{175}Au^m [J=(11/2-)] **
*^{179}Tl^m T : average 18Ba46=1.40(0.03) 11Ko.B=1.36(0.04) 10An01=1.46(0.04) **
*^{179}Tl^n T : symmetrized from 18Ba46=114(+18-10) **
*^{179}Pb T : other 10An01=3.5(+1.4-0.8) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{180}Er	−33180#	500#			2#	s	>550ns	0^+		18Fu08	I	2018	β^- ?;β^-n ?	
^{180}Tm	−38170#	400#			3#	s	>300ns		15			2012	β^- ?;β^-n ?	
^{180}Yb	−44720#	300#			2.4	m	0.5	0^+	15			1987	β^-=100	
^{180}Lu	−46680	70			5.7	m	0.1	5^+	15			1971	β^-=100	
^{180}Lu^m	−46670	70	13.9	0.3	∼ 1	s		3^-	15	95Me03	JT	1995	IT ?;β^- ?	
^{180}Lu^n	−46060	70	624.0	0.5	> 1	ms		(9^-)	15	01Wh02	EJT	2001	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{180}Hf	−49779.5	1.4				STABLE			0^+	15			1934	IS=35.08 33	
^{180}Hf^m	−48637.9	1.4	1141.552	0.015		5.53	h	0.02	8^-	15			1951	IT≈100;β^-=0.31 8	
^{180}Hf^n	−48405.1	1.4	1374.36	0.04		570	μs	20	4^-	15	15Ko14	J	1990	IT=100	*
^{180}Hf^p	−47294.0	1.5	2485.5	0.5		940	ns	110	12^+	15	16Ta23	T	2000	IT=100	
^{180}Hf^q	−46180.5	1.7	3599.0	1.0		90	μs	10	(18^-)	15			1999	IT=100	
^{180}Ta	−48933.6	2.1				8.154	h	0.006	1^+	15			1938	ε=85 3;β^-=15 3	
^{180}Ta^m	−48858.3	1.6	75.3	1.4	RQ	STABLE		>45 Py	9^-	15	17Le01	T	1940	IS=0.01201 32;β^- ?	
^{180}Ta^n	−47481.2	2.1	1452.39	0.22		31.2	μs	1.4	15^-	15			1996	IT=100	
^{180}Ta^p	−45254.7	2.3	3678.9	1.0		2.0	μs	0.5	(22^-)	15			2000	IT=100	
^{180}Ta^q	−44761.4	2.6	4172.2	1.6		17	μs	5	(24^+)	15	00Wh04	EJ	2000	IT=100	
^{180}W	−49636.2	1.4				1.59	Ey	0.5	0^+	15	14Mu.A	TD	1937	IS=0.12 1;α≈100;2β^+ ?	*
^{180}W^m	−48107.1	1.4	1529.05	0.04		5.47	ms	0.09	8^-	15			1978	IT=100	
^{180}W^n	−46371.5	1.4	3264.7	0.3		2.33	μs	0.19	14^-	15	15Ko14	TEJ	1966	IT=100	
^{180}Re	−45837	21				2.46	m	0.03	$(1)^-$	15			1955	β^+=100	
^{180}Re^m	−45750#	40#	90#	30#		> 1#	μs		$(4^+,5^+)$		05El10	J	2005	IT≈100;β^+ ?	
^{180}Re^n	−42280#	40#	3561#	30#		9.0	μs	0.7	21^-	15	05El10	TJD	2005	IT=100	*
^{180}Os	−44356	16				21.5	m	0.4	0^+	15			1967	β^+=100	
^{180}Ir	−37978	22				1.5	m	0.1	(5^+)	15			1972	β^+=100	
^{180}Pt	−34430	10				56	s	3	0^+	15	20Cu02	D	1966	β^+=99.48 5;α=0.52 5	
^{180}Au	−25626	5				7.9	s	0.3	(1^+)*	15	20Ha24	JTD	1977	β^+=99.42 10;α=0.58 10	*
^{180}Hg	−20251	13				2.59	s	0.01	0^+	15			1970	β^+=52 2;α=48 2	
^{180}Tl	−9390	70				1.09	s	0.01	(4^-)*	15	17Ba04	J	1987	β^+=93 3;α=7 3; β^+SF=0.0032 2	*
^{180}Pb	−1941	12				4.1	ms	0.3	0^+	15			1996	α=100	

*^{180}Hf^n T : other 16Ta23=520(80) **
*^{180}Hf^n I : 99Da09 (same group as 16Ta23) reported a 15(5)us, J=(10+) isomer at **
*^{180}Hf^n I : 2425.8(1.0) keV, but it was retracted by 16Ta23 **
*^{180}W T : others partial α half-life 04Co26=1.8(0.2) Ey; 2β^+ 03Da09>80 Py **
*^{180}Re^n E : 3471.8(0.6) keV above ^{180}Re^m in 05El10 **
*^{180}Au T : average 20Ha24=7.2(0.5) 77Hu05=8.1(0.3); other 93BoZK=9.7(0.6) **
*^{180}Tl D : %α 03An27=(2-12)%; %β^+SF from 13El08, supersedes **
*^{180}Tl D : 10An13=0.0036(0.0007); other 98To14∼1.0e-4 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{181}Tm	−35440#	500#				7#	s	>300ns	$1/2^+$#	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{181}Yb	−41090#	300#				1#	m	>300ns	$3/2^-$#	13	09St16	I	2000	β^- ?	
^{181}Lu	−44800	130				3.5	m	0.3	$7/2^+$#	06			1982	β^-=100	
^{181}Hf	−47403.0	1.4				42.39	d	0.06	$1/2^-$	06			1935	β^-=100	
^{181}Hf^m	−46807.7	1.4	595.27	0.04		80	μs	5	$9/2^+$	06	01Sh36	T	2001	IT=100	
^{181}Hf^n	−46359.5	1.6	1043.5	0.8		∼ 100	μs		$(17/2^+)$	06			2001	IT=100	
^{181}Hf^p	−45661.1	1.9	1741.9	1.3		1.5	ms	0.5	$(25/2^-)$	06			2001	IT=100	
^{181}Ta	−48439.1	1.6				STABLE			$7/2^+$*	06			1932	IS=99.98799 32	
^{181}Ta^m	−48432.9	1.6	6.237	0.020		6.05	μs	0.12	$9/2^-$*	06			1979	IT=100	
^{181}Ta^n	−47823.9	1.6	615.19	0.03		18	μs	1	$1/2^+$	06			1948	IT=100	
^{181}Ta^p	−47011	14	1428	14		140	ns	36	$19/2^+$#		98Sa60	ITD	1998	IT=100	*
^{181}Ta^q	−46955.7	1.6	1483.43	0.21		25.2	μs	1.8	$21/2^-$	06	98Wh02	T	1998	IT=100	*
^{181}Ta^r	−46211.2	1.8	2227.9	0.9		210	μs	20	$29/2^-$	06	98Wh02	J	1998	IT=100	
^{181}W	−48233.9	1.4				120.956	d	0.019	$9/2^+$	06	14Un01	T	1947	ε=100	*
^{181}W^m	−47868.4	1.4	365.55	0.13		14.59	μs	0.15	$5/2^-$	06			1968	IT=100	
^{181}W^n	−46580.9	1.4	1653.0	0.3		200	ns	13	$21/2^+$	06	93YeZX	ET	1973	IT=100	
^{181}Re	−46517	13				19.9	h	0.7	$5/2^+$*	06			1957	β^+=100	
^{181}Re^m	−46254	13	262.91	0.11		156.7	ns	1.9	$9/2^-$	06			1967	IT=100	
^{181}Re^n	−44861	13	1656.37	0.14		250	ns	10	$21/2^-$	06			1974	IT=100	
^{181}Re^p	−44636	13	1880.57	0.16		11.5	μs	0.9	$25/2^+$	06			2000	IT=100	
^{181}Re^q	−42648	13	3869.40	0.18		1.2	μs	0.2	$(35/2^-)$	06			2000	IT=100	
^{181}Os	−43550	25				105	m	3	$1/2^-$	06			1966	β^+=100	
^{181}Os^m	−43501	25	49.20	0.14		2.7	m	0.1	$7/2^-$	06			1966	β^+=100	
^{181}Os^n	−43393	25	156.91	0.15		262	ns	6	$9/2^+$	06			1974	IT=100	
^{181}Ir	−39463	5				4.90	m	0.15	$5/2^-$	06			1972	β^+=100	
^{181}Ir^m	−39174	5	289.33	0.13		298	ns		$5/2^+$	06			1992	IT=100	
^{181}Ir^n	−39097	5	366.30	0.22		126	ns	6	$9/2^-$	06			1992	IT=100	
^{181}Pt	−34381	14				52.0	s	2.2	$1/2^-$*	06	95Bi01	D	1966	β^+≈100;α=0.074 10	*
^{181}Pt^m	−34264	14	116.65	0.08		> 300	ns		$7/2^-$	06	90De03	J	1992	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{181}Au	−27871	20				13.7 s	1.4	(5/2$^-$)	06			1968	β^+=97.3 5;α=2.7 5	*
^{181}Au^p	−27660#	200#	210#	200#				(11/2$^-$)	06					
^{181}Hg	−20661	15				3.6 s	0.1	1/2$^-$*	06			1969	β^+=73 2;α=27 2; β^+p=0.014 3;$\beta^+\alpha$=9e-6 3	*
^{181}Hg^m	−20450	50	210	50	IT	480 μs	20	13/2$^+$	06	09An17	T	2009	IT=100	
^{181}Tl	−12799	9				2.9 s	0.1	1/2$^+$*	09	18Cu04	TD	1996	β^+ ?;α=8.6 6	*
^{181}Tl^m	−11963	9	835.9	0.4		1.40 ms	0.03	(9/2$^-$)	09	09An14	JD	1984	IT=99.60 4;α=0.40 6;β^+ ?	
^{181}Pb	−3110	90				39.0 ms	0.8	(9/2$^-$)	06	09An20	TJ	1989	$\alpha\approx$100;β^+ ?	*
^{181}Pb^m			*non−exist*		RN			13/2$^+$#		96To01	I			

*^{181}Ta^p E : 1403.2(0.6)+x keV with x<50 keV in 98Sa60 **
*^{181}Ta^p J : most likely E1 for the depopulating gamma to the 1403.2-keV (J=17/2-) **
*^{181}Ta^p J : level, as proposed in 98Dr09, and hence J=19/2+; 98Sa60 suggests **
*^{181}Ta^p J : J=15/2- for the 1403.2-keV level, but then J=19/2+ seems unlikely, **
*^{181}Ta^p J : since the depopulating gamma would be M2 and much longer half-life **
*^{181}Ta^p J : would be expected **
*^{181}Ta^q T : average 98Wh02=25(2) 98Dr09=23(+6-2) **
*^{181}W T : average 14Un01=121.03(0.07) 73My02=120.95(0.02); other **
*^{181}W T : 72Em01=121.53(0.09), outlier **
*^{181}Pt J : 99Le52=1/2 **
*^{181}Au J : favored α decay to ^{177}Ir (J=5/2-) **
*^{181}Hg J : 19Se04=1/2 **
*^{181}Hg D : %β^+p from I(p)/I(α)=5.0(0.8)e-4 in 71Ho07; **
*^{181}Hg D : %$\beta^+\alpha$ from I(α)/I(β^+)=1.2e-7 in 75Ho02 **
*^{181}Tl J : 17Ba04=1/2 **
*^{181}Tl T : others 98To14=3.2(0.3) 92Bo.D=3.4(0.6) **
*^{181}Pb T : average 09An20=36(2) 05Ca.A=39.6(0.9) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{182}Tm	−31490#	500#											β^- ?;β^-n ?	
^{182}Yb	−38900#	400#				30# s	>300ns	0$^+$	15	12Ku26	I	2012	β^- ?	
^{182}Lu	−41770#	200#				2.0 m	0.2	1$^-$#	15			1982	β^-=100	
^{182}Hf	−46050	6				8.90 My	0.09	0$^+$	15			1961	β^-=100	
^{182}Hf^m	−44877	6	1172.87	0.18		61.5 m	1.5	8$^-$	15	15Ko14	J	1971	β^-=54 2;IT=46 2	*
^{182}Hf^n	−43479	6	2571.3	1.2		40 μs	10	(13$^+$)	15			1999	IT=100	
^{182}Ta	−46430.7	1.6				114.74 d	0.12	3$^-$	15			1938	β^-=100	
^{182}Ta^m	−46414.4	1.6	16.273	0.004		283 ms	3	5$^+$	15			1968	IT=100	
^{182}Ta^n	−45911.1	1.6	519.577	0.016		15.84 m	0.10	10$^-$	15			1947	IT=100	
^{182}W	−48246.1	0.7				STABLE	>7.7Zy	0$^+$	15	04Co26	T	1930	IS=26.50 16;α ?	*
^{182}W^m	−46015.5	0.7	2230.65	0.14		1.3 μs	0.1	10$^+$	15	15Ko14	J	1969	IT=100	
^{182}Re	−45450	100			*	64.2 h	0.5	7$^+$*	15			1950	β^+=100	
^{182}Re^m	−45386	20	60	100	BD*	14.14 h	0.45	2$^+$*	15			1950	β^+=100	
^{182}Re^n	−45150	140	296	100		585 ns	30	(2)$^-$	15			1969	IT=100	*
^{182}Re^p	−44930	140	521	100		780 ns	90	(4$^-$)	15			1984	IT=100	*
^{182}Os	−44609	22				21.84 h	0.20	0$^+$	15			1950	ε=100	
^{182}Os^m	−42778	22	1831.4	0.3		780 μs	70	8$^-$	15	15Ko14	J	1966	IT=100	
^{182}Os^n	−37560	22	7049.5	0.4		150 ns	10	25$^+$	15	15Ko14	J	1988	IT=100	
^{182}Ir	−39052	21				15.0 m	1.0	3$^+$	15			1961	β^+=100	
^{182}Ir^m	−38981	21	71.02	0.17		170 ns	40	(5)$^+$	15			1990	IT=100	
^{182}Ir^n	−38876	21	176.4	0.3		130 ns	50	(6$^-$)	15			1990	IT=100	
^{182}Pt	−36168	13				2.67 m	0.12	0$^+$	15			1963	β^+=0.962 2;α=0.038 2	
^{182}Au	−28304	19				15.5 s	0.4	(2$^+$)*	15	20Ha24	J	1970	$\beta^+\approx$100;α=0.13 5	
^{182}Au^m	−28180	30	120	40		10# s		5$^-$#					β^+=?; IT ?	*
^{182}Hg	−23577	10				10.83 s	0.06	0$^+$	15	71Ho07	D	1968	β^+=86.2 9;α=13.8 9; β^+p<1e-5	*
^{182}Tl	−13327	12			*&	1.9 s	0.1	(4$^-$)*	10	16Va01	TD	1991	$\beta^+\approx$100;α>0.49; β^+SF<3.4e-6	*
^{182}Tl^m	−13280#	50#	50#	50#	*&	3.1 s	1.0	(7$^+$)*		91Bo02	TD	1991	$\beta^+\approx$100;α=2.5 14;IT ?	*
^{182}Tl^p	−12830#	100#	500#	100#				(10$^-$)						
^{182}Pb	−6825	12				55 ms	5	0$^+$	15			1986	$\alpha\approx$100;β^+ ?	

*^{182}Hf^m J : E1 to 8+ **
*^{182}W T : 04Co26>7.7Zy; others 03Da05>170Ey 03Ce01>25Ey 97Ge15>8.3Ey **
*^{182}Re^n E : 235.732(0.022) keV above ^{182}Re^m **
*^{182}Re^p E : 461.3(0.1) keV above ^{182}Re^m **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{182}Au^m I : direct β^+ feeding to 4+ and 5+ levels in ^{182}Pt (99Da18) **
*^{182}Au^m I : indicates the existence of an isomer **
*^{182}Hg D : %α average 97Ba21=13.3(0.5) 80Sc09=15.2(0.8); β^+p 71Ho07<1e-5 **
*^{182}Tl J : 17Ba04=(4) **
*^{182}Tl^m J : 17Ba04=(7) **
*^{182}Tl^m D : %α from 91Bo01<5% **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{183}Yb	−35000#	400#				30#	s	>300ns	$3/2^-$#	16	12Ku26	I	2012	β^- ?	
^{183}Lu	−39720	80				58	s	4	$7/2^+$#	16			1983	β^-=100	
^{183}Hf	−43280	30				1.018	h	0.002	$(3/2^-)$	16			1956	β^-=100	
^{183}Hf^m	−41820	70	1464	64		40	s	30	$27/2^-$#	16	10Re07	ETJ	2010	IT≈100;β^- ?	*
^{183}Ta	−45293.5	1.6				5.1	d	0.1	$7/2^+$*	16			1950	β^-=100	
^{183}Ta^m	−45220.3	1.6	73.164	0.014		106	ns	10	$9/2^-$	16			1967	IT=100	
^{183}Ta^n	−43959	14	1335	14		900	ns	300	$(19/2^+)$	16	09Sh17	ETJ	2009	IT=100	*
^{183}W	−46365.7	0.7				STABLE		>670Ey	$1/2^-$*	16			1930	IS=14.31 4;α ?	
^{183}W^m	−46056.2	0.7	309.492	0.004		5.30	s	0.08	$11/2^+$	16			1961	IT=100	
^{183}Re	−45810	8				70.0	d	1.4	$5/2^+$*	16			1950	ε=100	
^{183}Re^m	−43903	8	1907.21	0.15		1.04	ms	0.04	$25/2^+$	16	15Ko14	J	1966	IT=100	
^{183}Os	−43660	50				13.0	h	0.5	$9/2^+$*	16			1950	β^+=100	
^{183}Os^m	−43490	50	170.73	0.07		9.9	h	0.3	$1/2^-$*	16			1958	β^+=85 2;IT=15 2	
^{183}Ir	−40202	25				58	m	5	$5/2^-$	16	61Di04	T	1961	β^+≈100;α ?	*
^{183}Pt	−35773	14				6.5	m	1.0	$1/2^-$*	16			1963	β^+≈100;α=0.0096 5	*
^{183}Pt^m	−35738	14	34.74	0.07		43	s	5	$7/2^-$*	16			1979	β^+=96.9 8;IT=3.1 8;α ?	*
^{183}Pt^n	−35577	14	195.90	0.10		> 150	ns		$9/2^+$	16			1990	IT=100	
^{183}Au	−30191	9				42.8	s	1.0	$5/2^-$*	16			1968	β^+=99.45 25;α=0.55 25	*
^{183}Au^m	−30118	9	73.10	0.01		> 1	μs		$(1/2)^+$	16	17Ve04	E	1984	IT=100	
^{183}Au^p	−29960	9	230.6	0.6		< 1	μs		$(11/2)^-$	16			1984	IT=100	
^{183}Hg	−23805	7				9.4	s	0.7	$1/2^-$*	16			1969	β^+=88.3 20;α=11.7 20; β^+p=2.6e-4 6	*
^{183}Hg^m	−23601	13	204	14	AD	> 5#	μs		$13/2^+$#		81Mi12	I	1981	IT ?;β^+ ?	*
^{183}Tl	−16587	9				6.9	s	0.7	$1/2^+$*	16			1980	β^+=?;α ?	*
^{183}Tl^m	−15959	9	628.7	0.5	IT	53.3	ms	0.3	$(9/2^-)$	16	11Ve.A	E	1980	IT ?;α=1.5 3;β^+ ?	*
^{183}Tl^n	−15612	9	975.3	0.6		1.48	μs	0.10	$(13/2^+)$	16			2001	IT=100	
^{183}Pb	−7580	29				535	ms	30	$3/2^-$*	16			1980	α≈100;β^+ ?	*
^{183}Pb^m	−7486	28	94	8	AD	415	ms	20	$13/2^+$*	16			1980	α≈100;β^+ ?;IT ?	

*^{183}Hf^m T : symmetrized from 10Re07=10(+48-5), value for q=71+ (H+ like ion); the **
*^{183}Hf^m T : actual half-life could be shorter **
*^{183}Ta^n E : from 1310.16 + x keV with x<50 keV in 09Sh17 **
*^{183}Os^m J : 75Ru06,78Ru04=1/2 **
*^{183}Ir T : average 61Di04=55(7) 61La05=60(6) **
*^{183}Pt J : 92Hi07,99Le52=1/2 **
*^{183}Pt^m J : 99Le52=7/2 **
*^{183}Au J : 89Wa11,94Pa37=5/2 **
*^{183}Hg J : 72Bo09,76Bo09,19Se04=1/2 **
*^{183}Hg D : %β^+p from 71Ho07=I(p)/I(a)=2.2(0.3)e-5 **
*^{183}Hg^m I : lack of 6073α-gamma coincidences in ^{187}Pb^m decay **
*^{183}Tl J : 17Ba04j,13Ba41=1/2+ **
*^{183}Tl^m E : uncertainty estimated by Nubase **
*^{183}Pb J : 09Se13=3/2 **
*^{183}Pb^m J : 09Se13=13/2 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{184}Yb	−32600#	500#				7#	s	>300ns	0^+	13	12Ku26	I	2012	β^- ?	
^{184}Lu	−36300#	200#				20	s	3	(3^+)	10	95Kr04	TJ	1989	β^-=100	
^{184}Hf	−41500	40				4.12	h	0.05	0^+	10			1973	β^-=100	
^{184}Hf^m	−40230	40	1272.2	0.4		48	s	10	8^-	10	12Re.A	D	1995	IT≈100;β^- ?	*
^{184}Hf^n	−39020	40	2477	10		16	m	7	15^+#	10	10Re07	ET	2010	β^- ?; IT ?	*
^{184}Ta	−42839	26				8.7	h	0.1	(5^-)	10			1955	β^-=100	
^{184}W	−45705.5	0.7				STABLE		>8.9Zy	0^+	10	04Co26	T	1930	IS=30.64 2;α ?	
^{184}W^m	−44420.5	0.7	1284.997	0.008		8.33	μs	0.18	5^-	10			1969	IT=100	
^{184}W^n	−41577.8	0.9	4127.7	0.5		188	ns	38	(14^+)	10	15Ko14	JE	2004	IT=100	
^{184}Re	−44220	4				35.4	d	0.7	3^-	10			1940	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{184}Re^{m}	−44032	4	188.0463	0.0017		169 d 8	8^+	10			1964	IT=74.5 8;ε=25.5 8	*
^{184}Os	−44252.6	0.8				11.2 Ty 2.3	0^+	10	14Pe22	T	1937	IS=0.02 2;α ?;2β^+ ?	*
^{184}Ir	−39611	28				3.09 h 0.03	5^-	10			1960	β^+=100	
^{184}Ir^{m}	−39385	28	225.65	0.11		470 μs 30	3^+	10			1988	IT=100	
^{184}Ir^{n}	−39283	28	328.40	0.24		350 ns 90	7^+	10			1988	IT=100	*
^{184}Pt	−37332	15				17.3 m 0.2	0^+	10	95Bi01	D	1963	$\beta^+\approx$100;α=0.0017 7	
^{184}Pt^{m}	−35492	15	1840.3	0.8		1.01 ms 0.05	8^-	10			1966	IT=100	*
^{184}Au	−30319	22				20.6 s 0.9	5^+*	10	95Bi01	D	1969	$\beta^+\approx$100;$\alpha\approx$0.013 3	
^{184}Au^{m}	−30251	22	68.46	0.04		47.6 s 1.4	2^+*	10	95Bi01	D	1969	β^+=?;IT=30 10;$\alpha\approx$0.013 3	
^{184}Hg	−26345	10				30.87 s 0.26	0^+	10	80Sc09	D	1969	β^+=98.89 6;α=1.11 6	*
^{184}Tl	−16883	10			*	9.5 s 0.2	2^-*	10	16Va01	TJD	1976	β^+=98.78 30;α=1.22 30	
^{184}Tl^{m}	−16930	30	−50	30	AD*	10.6 s 0.5	(7^+)		16Va01	JTD	2016	β^+=99.53 6;IT ?;α=0.47 6	*
^{184}Tl^{n}	−16430	30	450	30	AD	47.1 ms 0.7	(10^-)	10	15Va10	TD	1984	IT$\approx$100;α=0.089 19	
^{184}Pb	−11052	13				490 ms 25	0^+	10	04An07	D	1980	α=80 11;β^+ ?	*
^{184}Bi	1250#	120#			*&	6.6 ms 1.5	3^+#	10			2003	α=100	
^{184}Bi^{m}	1400#	160#	150#	100#	*&	13 ms 2	10^-#	10			2002	α=100	

*^{184}Hf^{m} E : other 10Re07=1264(10) **
*^{184}Hf^{m} T : other 12Re19=113(+60-47) 10Re07=113(+74-40) for q=72+ (bare ion) **
*^{184}Hf^{m} J : from 15Ko14 **
*^{184}Hf^{n} T : symmetrized from 12Re19=12(+8-6) for q=72+; supersedes 10Re07=12(+10-4) **
*^{184}Re^{m} J : E5 to 3- **
*^{184}Os T : α decay half-life from 14Pe22; other 2β^+ 13Be07>25Py **
*^{184}Ir^{n} J : M2 to 5- **
*^{184}Pt^{m} T : other 17Pr03=0.86(0.10) **
*^{184}Hg D : %α other 70Ha18=1.25(0.20) **
*^{184}Tl^{m} T : average 76Co24=11(1), based on ce-gamma-time events below 8+ state in **
*^{184}Tl^{m} T : ^{180}Hg, 16Va01=10.1(0.5), using laser-ionization data **
*^{184}Pb D : %α average 04An07=80(15) 03Va16=80(15) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{185}Yb	−28480#	500#				5# s >300ns	$9/2^-$#	13	12Ku26	I	2012	β^- ?	
^{185}Lu	−33960#	300#				20# s >300ns	$7/2^+$#	13	09St16	I	2009	β^- ?	
^{185}Hf	−38320	60				3.5 m 0.6	$(9/2^-)$	06			1993	β^-=100	*
^{185}Ta	−41394	14				49.4 m 1.5	$(7/2^+)$	06			1950	β^-=100	
^{185}Ta^{m}	−40988	14	406	1		900 ns 300	$(3/2^+)$	06	07Sh42	ETJ	2007	IT=100	
^{185}Ta^{n}	−40121	14	1273.4	0.4		11.8 ms 1.4	$21/2^-$	06	09La17	EJT	1999	IT=100	
^{185}W	−43387.9	0.7				75.1 d 0.3	$3/2^-*$	06			1940	β^-=100	
^{185}W^{m}	−43190.5	0.7	197.383	0.023		1.597 m 0.004	$11/2^+$	06	94It.A	T	1950	IT=100	
^{185}Re	−43819.0	0.8				STABLE	$5/2^+*$	06			1931	IS=37.40 5	
^{185}Re^{m}	−41694.9	0.9	2124.1	0.4		200 ns 4	$25/2^+$	06	06Le.A	EJT	1997	IT=100	*
^{185}Os	−42805.9	0.8				92.95 d 0.09	$1/2^-$	06	12Kr05	T	1947	ε=100	
^{185}Os^{m}	−42703.5	0.8	102.37	0.11		3.0 μs 0.4	$7/2^-$	06	FGK128	J	1970	IT=100	*
^{185}Os^{n}	−42530.4	0.8	275.53	0.12		780 ns 50	$11/2^+$	06			1970	IT=100	
^{185}Ir	−40336	28				14.4 h 0.1	$5/2^-*$	06			1958	β^+=100	
^{185}Ir^{m}	−38140	40	2197	23		120 ns 20	(23/2,25/2)#	06			1979	IT=100	*
^{185}Pt	−36688	26				70.9 m 2.4	$9/2^+*$	06	91Bi04	D	1960	$\beta^+\approx$100;α=0.0050 20	*
^{185}Pt^{m}	−36585	26	103.41	0.05		33.0 m 0.8	$1/2^-*$	06			1970	$\beta^+\approx$100;IT ?	*
^{185}Pt^{n}	−36487	26	200.89	0.04		728 ns 20	$5/2^-$	06			1996	IT=100	
^{185}Au	−31858.1	2.6			*	4.25 m 0.06	$5/2^-*$	06			1960	β^+=99.74 6;α=0.26 6	
^{185}Au^{m}	−31810#	50#	50#	50#	*	6.8 m 0.3	$1/2^+$#	06			1960	$\beta^+\approx$100;IT ?	
^{185}Hg	−26184	14				49.1 s 1.0	$1/2^-*$	06			1960	β^+=94 1;α=6 1	*
^{185}Hg^{m}	−26080	14	103.7	0.4		21.6 s 1.5	$13/2^+*$	06	13Sa43	E	1970	IT=54 10;β^+=46 10;$\alpha\approx$0.03	*
^{185}Tl	−19758	21				19.5 s 0.5	$1/2^+*$	06	13Ba41	J	1976	$\beta^+\approx$100;α ?	
^{185}Tl^{m}	−19303	21	454.8	1.5	IT	1.93 s 0.08	$9/2^-*$	06	13Ba41	J	1976	IT$\approx$100;α=?;β^+ ?	
^{185}Pb	−11541	16			*	6.3 s 0.4	$3/2^-*$	06			1975	β^+=66 25;α=34 25	*
^{185}Pb^{m}	−11470	50	70	50	AD*	4.07 s 0.15	$13/2^+*$	06	02An15	T	1975	α=50 25;β^+ ?	*
^{185}Bi	−2240#	80#			*&	2# ms	$9/2^-$#		96Da06	J	1996	p ?;α ?	*
^{185}Bi^{m}	−2156	13	80#	80#	*&	58 μs 4	$1/2^+$	06			1996	p=90 2;α=10 2	
^{185}Bi^{n}	−2060#	110#	180#	80#	EU	50 μs 10	$13/2^+$#		04An07	ITD	2004	p=?;α=?	*

*^{185}Hf J : β^- decay to J=9/2+ in ^{185}Ta **
*^{185}Re^{m} T : others: 97Sh37=123(23) 02Pf01=120(15) **
*^{185}Re^{m} E : from 15Ko14 **
*^{185}Os^{m} J : E1 from 9/2+ **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{185}Ir^m E : 2157.3(0.5) + x keV; x<80 keV **
*^{185}Pt J : 92Hi07,99Le52=9/2 **
*^{185}Pt D : %α from E(a)=4444(10) keV in 91Bi04 **
*^{185}Pt^m J : 92Hi07,99Le52=1/2 **
*^{185}Hg J : 19Se04=1/2 **
*^{185}Hg^m J : 19Se04=13/2 **
*^{185}Pb J : 09Se13=3/2 **
*^{185}Pb^m T : average 02An15=4.3(0.2) 80Sc09=3.73(0.24) (excluding the 6.1 s activity) **
*^{185}Pb^m J : 09Se13=13/2 **
*^{185}Bi T : estimated from J=9/2- isomers in odd Bi and Tl isotopes **
*^{185}Bi^n E : 100 keV above ^{185}Bi^m **

^{186}Lu	−30320#	400#				6#	s	>300ns		13	12Ku26	I	2012	β^- ?;β^-n ?	
^{186}Hf	−36420	50				2.6	m	1.2	0^+	03			1998	β^-=100	
^{186}Hf^m	−33450	70	2968	43		> 20	s		17^+#		10Re07	ET	2010	β^- ?; IT ?	*
^{186}Ta	−38610	60				10.5	m	0.3	3#	03			1955	β^-=100	*
^{186}Ta^m	−38270	60	336	20		1.54	m	0.05	9^+#		04Xu08	T	2010	β^- ?; IT ?	*
^{186}W	−42508.6	1.2				STABLE		>4.1Ey	0^+	03	03Da09	T	1930	IS=28.43 19;2β^- ?;α ?	*
^{186}W^m	−40991.4	1.3	1517.2	0.6		18	μs	1	7^-	03	12La.A	J	1998	IT=100	
^{186}W^n	−38965.8	2.4	3542.8	2.1		2.0	s	0.2	16^+	03	12La.A	TJ	1998	IT=100	
^{186}Re	−41927.3	0.8				3.7185	d	0.0005	1^-*	03	FGK204	T	1939	β^-=92.53 10;ε=7.47 10	
^{186}Re^m	−41779.1	0.9	148.2	0.5		∼ 200	ky		(8^+)	03	15Ma60	E	1972	IT≈100;β^- ?	
^{186}Os	−43000.0	0.8				2.0	Py	1.1	0^+	03			1931	IS=1.59 64;α=100	
^{186}Ir	−39172	17				16.64	h	0.03	5^+*	03			1958	β^+=100	
^{186}Ir^m	−39171	17	0.8	0.4		1.92	h	0.05	2^-	03	91Be25	ET	1962	β^+≈75;IT≈25	*
^{186}Pt	−37864	22				2.08	h	0.05	0^+	03			1961	β^+=100;α≈1.4e-4	
^{186}Au	−31715	21				10.7	m	0.5	3^-*	03			1960	β^+=100;α=0.0008 2	
^{186}Au^m	−31670#	40#	50#	30#		> 1	μs		6^-#					IT ?;β^+ ?	*
^{186}Au^n	−31487	21	227.77	0.07		110	ns	10	2^+	03			1983	IT=100	
^{186}Hg	−28539	12				1.38	m	0.06	0^+	03			1960	β^+≈100;α=0.016 5	
^{186}Hg^m	−26322	12	2217.3	0.4		82	μs	5	(8^-)	03			1984	IT=100	
^{186}Tl	−19883	21			*&	3.5	s	0.5	(2^-)	03	20St11	TDJ	1975	β^+ ?;α=?	*
^{186}Tl^m	−19860	30	20	40	*&	27.5	s	1.0	7^+*	03	13Ba41	J	1975	β^+≈100;α≈0.006	
^{186}Tl^n	−19490	30	390	40	MD	3.40	s	0.09	10^-*	03	20St11	TD	1977	IT<94.1 3;β^+>5.9 3	*
^{186}Pb	−14681	11				4.82	s	0.03	0^+	03			1972	β^+ ?;α=40 8	
^{186}Bi	−3145	17			*	14.8	ms	0.7	(3^+)	03	13La02	D	1997	α≈100;β^+=?;β^+SF≈0.011	*
^{186}Bi^m	−2980#	100#	170#	100#	*	9.8	ms	0.4	(10^-)	03	13La02	D	1984	α≈100;β^+=?;β^+SF≈0.011	*
^{186}Po	4102	18				34	μs	12	0^+	13	13An13	T	2005	α≈100;p ?	*

*^{186}Hf^m T : for q=72+ (bare ion) in 10Re07; the actual half-life could be shorter **
*^{186}Ta J : direct β^- feeding to 3- in ^{186}Hf; conf p7/2[404]n1/2[510],K=3- or **
*^{186}Ta J : p9/2[514]n3/2[512],K=3+ **
*^{186}Ta^m T : other 12Re19=3.0(+1.5-0.8) q=72+(H+ like ion); supersedes **
*^{186}Ta^m T : 10Re07=3.4(+2.4-1.4) **
*^{186}Ta^m E : from 10Re07 **
*^{186}W T : the limit given is for 2β^- decay; α decay 04Co26>8.2 Zy **
*^{186}W T : 03Da05>170 Ey 03Ce01>27 Ey 97Ge15>6.5 Ey **
*^{186}Ir^m T : average 91Be25=1.90(0.05) 70Fi.A=2.0(0.1) **
*^{186}Au^m I : floated strongly-coupled band in 92Ja01; conf p3/2[532]n9/2[624],K=6-, **
*^{186}Au^m I : same as the ground state where K=3- **
*^{186}Tl T : symmetrized from 20St11=3.4(+0.5-0.4) **
*^{186}Tl^n E : 374.2(0.1) keV above ^{186}Tl^m **
*^{186}Tl^n J : 13Ba41=10 **
*^{186}Bi T : average 03An27=14.8(0.8) 97Ba21=15.0(1.7) **
*^{186}Bi D : %β^+SF 13La02=0.022 13 for both isomers **
*^{186}Bi^m T : from 03An27 **
*^{186}Bi^m D : %β^+SF 13La02=0.022 13 for both isomers **
*^{186}Po T : symmetrized from 13An13=28(+16-6) **

^{187}Lu	−27770#	400#				7#	s	>300ns	$7/2^+$#	13	12Ku26	I	2012	β^- ?	
^{187}Hf	−33000#	200#				14#	s	>300ns	$9/2^-$#	09	99Be63	I	1999	β^- ?	
^{187}Hf^m	−32500#	360#	500#	300#		270	ns	80	$3/2^-$#		09Al30	TD	2009	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{187}Ta	−36900	60				2.3	m	6	(7/2$^+$)	09	10Re07	T	1999	β^-=100	*
^{187}Ta^m	−35110	60	1778	1		7.3	s	0.9	(25/2$^-$)		20Wa29	ETJ	2010	IT≈100;β^- ?	*
^{187}Ta^n	−33970	60	2935	14		> 5	m		41/2$^+$#		10Re07	ET	2010	β^- ?; IT ?	*
^{187}W	−39904.0	1.2				23.809	h	0.025	3/2$^-$*	09	19Kr02	T	1940	β^-=100	*
^{187}W^m	−39493.9	1.2	410.06	0.04		1.38	μs	0.07	11/2$^+$	09	08Bo26	J	2008	IT=100	*
^{187}Re	−41216.5	0.7				41.6	Gy	0.02	5/2$^+$*	09	01Be81	T	1931	IS=62.60 5;β^-=100;α=0	*
^{187}Re^m	−41010.3	0.7	206.2473	0.0010		555.3	ns	1.7	9/2$^-$	09			1949	IT=100	
^{187}Re^n	−39534.5	0.9	1682.0	0.6		354	ns	62	21/2$^+$	09	16Re02	ETJ	2003	IT=100	
^{187}Os	−41219.0	0.7				STABLE		>3.2Py	1/2$^-$*	09			1931	IS=1.96 17;α ?	*
^{187}Os^m	−41118.6	0.7	100.45	0.04		112	ns	6	7/2$^-$	09			1964	IT=100	
^{187}Os^n	−40961.9	0.7	257.10	0.07		231	μs	2	11/2$^+$	09			1964	IT=100	
^{187}Ir	−39549	28				10.5	h	0.3	3/2$^+$*	09			1958	β^+=100	
^{187}Ir^m	−39363	28	186.16	0.04		30.3	ms	0.6	9/2$^-$	09			1963	IT=100	
^{187}Ir^n	−39115	28	433.75	0.06		152	ns	12	11/2$^-$	09			1969	IT=100	
^{187}Ir^p	−37061	28	2487.7	0.4		1.8	μs	0.5	29/2$^-$		10Mo09	ETJ	2010	IT=100	
^{187}Pt	−36685	24				2.35	h	0.03	3/2$^-$*	09			1961	β^+=100	*
^{187}Pt^m	−36511	24	174.38	0.22		311	μs	15	11/2$^+$	09			1976	IT=100	*
^{187}Au	−33029	22				8.3	m	0.2	1/2$^+$*	09			1955	β^+≈100;α ?	
^{187}Au^m	−32909	22	120.33	0.14		2.3	s	0.1	9/2$^-$*	09	20Ba29	J	1983	IT=100	
^{187}Hg	−28119	13				1.9	m	0.3	3/2$^-$*	09	70Ha18	TD	1960	β^+=100;α ?	*
^{187}Hg^m	−28060	15	58	14	MD	2.4	m	0.3	13/2$^+$*	09	70Ha18	D	1970	β^+=100;α ?	*
^{187}Tl	−22445	8				∼ 51	s		1/2$^+$	09			1976	β^+≈100;α ?	
^{187}Tl^m	−22111	8	334	3	AD	15.60	s	0.12	9/2$^-$*	09	13Ba41	J	1976	IT=?;β^+=?;α=0.15 5	
^{187}Tl^n	−20570#	50#	1875#	50#		1.11	μs	0.7		09	00By02	T	2000	IT=100	*
^{187}Tl^p	−19863	8	2582.5	0.3		693	ns	38	29/2$^+$#	09			2000	IT=100	
^{187}Pb	−14987	5			*	15.2	s	0.3	3/2$^-$*	09			1972	β^+=90.5 20;α=9.5 20	*
^{187}Pb^m	−14968	11	19	10	MD*	18.3	s	0.3	13/2$^+$*	09			1972	β^+=88 2;α=12 2	*
^{187}Bi	−6383	10				37	ms	2	(9/2$^-$)	09			1999	α=100	*
^{187}Bi^m	−6275	12	108	8	AD	370	μs	20	1/2$^+$	09			1984	α=100	*
^{187}Bi^n	−6131	10	252	3		7	μs	5	(13/2$^+$)	09	02Hu14	ETJ	2002	IT=100	*
^{187}Po	2820	30			*	1.40	ms	0.25	1/2$^-$,5/2$^-$	09			2005	α≈100;β^+ ?	*
^{187}Po^m	2830	40	4	27	AD*	0.5	ms		13/2$^+$#		06An11	ETD	2006	α≈100;β^+ ?	

*^{187}Ta J : from 20Wa29 **
*^{187}Ta^m TE : other 10Re07=22(9) s for q=73+ (bare ion); E=1789(13) keV in 10Re07 **
*^{187}Ta^n T : from 10Re07 for q=73+ (bare ion) **
*^{187}W T : average 19Kr0=23.80(0.03) 64An02=23.72(0.06) 57Wr37=24.04(0.09) **
*^{187}W T : 53Ei02=23.85(0.08) **
*^{187}W^m J : E1 to 9/2-; l(d,p)=(6) **
*^{187}Re T : recommended in 01Be81, based on 96Sm.A data, in agreement **
*^{187}Re T : with 01Ga01=41.2(1.1) (direct measurement); other: 96Bo37=32.9(2.0) y **
*^{187}Re T : for q=75+ (bare ion) **
*^{187}Os T : from 20Be23 for T1/2(α,1/2$^-$->3/2$^-$) **
*^{187}Pt J : 92Hi07=3/2 **
*^{187}Pt^m J : M2 to 7/2- **
*^{187}Hg T : from 70Ha18; other 98Ru04=2.4 m, but no uncertainty given **
*^{187}Hg^m T : from 70Ha18; other 98Ru04=2.2 m, but no uncertainty given **
*^{187}Tl^n E : 1433.23(0.19)+191+201+x keV; x=50#(50#) keV estimated by Nubase **
*^{187}Pb J : 09Se13=3/2 **
*^{187}Pb^m J : 09Se13=13/2 **
*^{187}Bi J : favored α decay to ^{183}Tl^m [J=(9/2-)] **
*^{187}Bi^m J : favored α decay to ^{183}Tl (J=1/2+) **
*^{187}Bi^n T : symmetrized from 02Hu14=3.2(+7.6-2.0) **
*^{187}Bi^n E : 02Hu14=252 keV gamma at the focal plane of RITU separator; **
*^{187}Bi^n E : uncertainty estimated by Nubase **
*^{187}Po J : favored α decay to J=1/2-,5/2- level in ^{183}Pb **

^{188}Lu	−23820#	400#				1#	s	>300ns		18	12Ku26	I	2012	β^- ?;β^-n ?	
^{188}Hf	−30830#	300#				7#	s	>300ns	0$^+$	18	99Be63	I	1999	β^- ?	
^{188}Ta	−33910#	200#				19.6	s	2.0	(1$^-$)	18			1999	β^-=100	
^{188}Ta^m	−33810#	200#	99	33		19.6	s	2.0	(7$^-$)	18			2005	IT ?;β^- ?	
^{188}Ta^n	−33520#	200#	391	33		3.6	μs	0.4	10$^+$#	18			2005	IT=100	
^{188}W	−38668	3				69.77	d	0.05	0$^+$	18	14Un01	T	1951	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$^{188}W^m$	−36741	3	1926.7	0.8		109.5	ns	3.5	8^-	18			2010	IT=100	
^{188}Re	−39016.9	0.7				17.005	h	0.003	1^-*	18			1939	β^-=100	
$^{188}Re^m$	−38844.8	0.7	172.0848	0.0024		18.59	m	0.04	6^-	18			1953	IT=100	
^{188}Os	−41137.3	0.7				STABLE		>3.3Ey	0^+	18			1931	IS=13.24 27;α ?	*
^{188}Ir	−38345	9				41.5	h	0.5	1^-*	18			1950	β^+=100	
$^{188}Ir^m$	−37381	25	964	23		4.15	ms	0.15	11^-#	18			1971	IT≈100;β^+ ?	*
^{188}Pt	−37821	5				10.16	d	0.18	0^+	18			1954	ε=100;α=2.6e-5 3	
^{188}Au	−32371.3	2.7				8.84	m	0.06	1^-*	18			1955	β^+=100	
^{188}Hg	−30198	7				3.25	m	0.15	0^+	18			1960	β^+=100;α=3.7e-5 8	
$^{188}Hg^m$	−27474	7	2724.1	0.4		142	ns	14	12^+	18	83Ha15	T	1983	IT=100	*
^{188}Tl	−22336	30			*	71	s	2	2^-#	18			1970	β^+=100	
$^{188}Tl^m$	−22308	9	30	30	MD*	71.5	s	1.5	7^+*	18	13Ba41	J	1970	β^+=100	*
$^{188}Tl^n$	−22040	40	299	30		41	ms	4	9^-	18			1981	IT≈100;β^+ ?	*
^{188}Pb	−17811	10				25.1	s	0.1	0^+	18			1972	β^+=91.5 5;α=8.5 5	
$^{188}Pb^m$	−15234	10	2577.2	0.4		800	ns	20	8^-	18			1999	IT=100	
$^{188}Pb^n$	−15101	10	2709.8	0.5		94	ns	12	12^+	18			2004	IT=100	
$^{188}Pb^p$	−13028	10	4783.4	0.7		440	ns	60	(19^-)	18			2000	IT=100	
^{188}Bi	−7195	11			&	60	ms	3	(3^+)	18	13La02	TD	1980	α≈100;β^+ ?;β^+SF=0.0014 7	*
$^{188}Bi^m$	−7130	30	66	30	AD	> 5	μs		7^+#				1984	IT ?;α ?;β^+ ?	
$^{188}Bi^n$	−7040	30	153	30	AD &	265	ms	15	(10^-)	18	13La02	TD	1984	α=≈100;β^+ ?; β^+SF=0.0046 9	*
^{188}Po	−544	20				270	μs	30	0^+	18			1999	α≈100;β^+ ?	

*^{188}Os T : from 20Be23 for T1/2(α,0^+->2^+) **
*$^{188}Ir^m$ E : 923.53(0.22) + x; x<80 keV **
*$^{188}Hg^m$ T : average 83Ha15=134(15) 04Gl04=187(35) **
*$^{188}Tl^m$ J : 92Me07,13Ba41=7 **
*$^{188}Tl^n$ E : 268.8(0.2) keV above $^{188}Tl^m$ from 91Va04 **
*^{188}Bi D : %β^+SF from 20An12=0.0004(0.0002)-0.0018(0.0007); other **
*^{188}Bi D : 13La02=0.0032(0.0016) for both β^+SF decaying isomers **
*^{188}Bi J : from 20An12 **
*$^{188}Bi^n$ D : %β^+SF from 20An12; other 13La02=0.0032(0.0016) for both β^+SF decaying **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{189}Hf	−27150#	300#				400#	ms	>300ns	$3/2^-$#	17	09Al30	I	2009	β^-=100	
^{189}Ta	−31960#	200#				20#	s	>300ns	$7/2^+$#	17	99Be63	I	1999	β^-=100	
$^{189}Ta^m$	−30310#	220#	1650#	100#		1.6	μs	0.2	$21/2^-$#		09Al30	TD	2009	IT=100	*
^{189}W	−35810#	200#				11.6	m	0.2	$9/2^-$#	17			1963	β^-=100	
^{189}Re	−37979	8				24.3	h	0.4	$5/2^+$	17			1963	β^-=100	
$^{189}Re^m$	−37854	9	125	3		2#	μs		$9/2^-$		FGK209	TIJ		IT ?	*
$^{189}Re^n$	−36208	8	1770.9	0.6		223	μs	14	$29/2^+$	17	16Re02	JTE	2016	IT=100	
^{189}Os	−38986.8	0.7				STABLE		>3.3Py	$3/2^-*$	17			1931	IS=16.15 23;α ?	*
$^{189}Os^m$	−38956.0	0.7	30.82	0.02		5.81	h	0.10	$9/2^-$	17			1960	IT≈100;β^- ?	
^{189}Ir	−38450	13				13.2	d	0.1	$3/2^+*$	17			1955	ε=100	
$^{189}Ir^m$	−38078	13	372.17	0.04		13.3	ms	0.3	$11/2^-$	17			1960	IT=100	
$^{189}Ir^n$	−36117	13	2332.8	0.3		3.7	ms	0.2	$25/2^+$	17	75Ke06	J	1975	IT=100	
^{189}Pt	−36469	10				10.87	h	0.12	$3/2^-*$	17			1955	β^+=100	*
$^{189}Pt^m$	−36296	10	172.79	0.06		464	ns	25	$9/2^-$	17			1970	IT=100	
$^{189}Pt^n$	−36278	10	191.4	0.2		143	μs	5	$(13/2^+)$	17			1976	IT=100	
^{189}Au	−33582	20				28.7	m	0.4	$1/2^+*$	17			1955	β^+=100;α<3e-5	
$^{189}Au^m$	−33335	20	247.25	0.16		4.59	m	0.11	$11/2^-*$	17			1966	β^+≈100;IT ?	
$^{189}Au^n$	−33257	20	325.12	0.16		190	ns	15	$9/2^-$	17			1975	IT=100	
$^{189}Au^p$	−31027	20	2554.8	0.8		242	ns	10	$31/2^+$	17			1975	IT=100	
^{189}Hg	−29630	30				7.6	m	0.2	$3/2^-*$	17			1955	β^+=100;α ?	
$^{189}Hg^m$	−29548	18	80	30	MD	8.6	m	0.2	$13/2^+*$	17			1966	β^+=100;α ?	*
^{189}Tl	−24616	8				2.3	m	0.2	$1/2^+$	17			1972	β^+=100	
$^{189}Tl^m$	−24331	8	285	6	AD	1.4	m	0.1	$9/2^-*$	17			1972	β^+≈100;IT ?	*
^{189}Pb	−17844	14				39	s	8	$3/2^-*$	17	09Sa09	T	1972	β^+=99.58 15;α=0.42 15	*
$^{189}Pb^m$	−17804	14	40	4	AD	50.5	s	2.1	$13/2^+*$	17	09Sa09	T	2009	β^+≈100;α≈0.4;IT ?	*
$^{189}Pb^n$	−15369	15	2475	4		26	μs	5	$31/2^-$	17	09Dr03	J	2005	IT=100	*
^{189}Bi	−10065	21				688	ms	5	$9/2^-*$	17			1973	α≈100;β^+ ?	*
$^{189}Bi^m$	−9881	21	184	5	AD	5.0	ms	0.1	$1/2^+$	17			1984	α=83 5; IT=17 5	*
$^{189}Bi^n$	−9707	21	357.6	0.5		880	ns	50	$13/2^+$	17			2001	IT=100	*
^{189}Po	−1422	22				3.5	ms	0.5	$(5/2^-)$	17			1999	α≈100;β^+ ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{189}Ta^m	T : other 11St21=0.58(0.22), possibly a different isomer														**
*^{189}Ta^m	E : 11St11=154,284,343,389,482 keV gammas in a mutual coincidence; other														**
*^{189}Ta^m	E : 09Al30=57,83,134,154,199,246,284,389,481 keV gammas in singles														**
*^{189}Re^m	IJ : M2 to 5/2+; existence of a similar isomer in ^{187}Re														**
*^{189}Re^m	T : estimated from B(M2)=0.7 (W.u.) for ^{187}Re^m														**
*^{189}Os	T : from 20Be23 for T1/2(α,3/2$^-$->3/2$^-$)														**
*^{189}Pt	J : 75Ru06,92Hi07=3/2														**
*^{189}Hg^m	J : 79Da06=13/2														**
*^{189}Tl^m	J : 85Bo46,13Ba41=9/2														**
*^{189}Pb	J : 09Se13=3/2														**
*^{189}Pb	D : %α from 74Ho26														**
*^{189}Pb^m	T : average 09Sa09=50(3) 72Ga27=51(3)														**
*^{189}Pb^m	J : 09Se13=13/2														**
*^{189}Pb^n	E : 2434.50(0.18) keV above ^{189}Pb^m														**
*^{189}Pb^n	T : symmetrized from τ=32(+10-2) us in 05Ba51														**
*^{189}Bi	J : 17Ba12,12Ba32,95Ba75=(9/2); favored α decay to ^{185}Tl^m														**
*^{189}Bi	J : [J=(9/2-)]														**
*^{189}Bi^m	J : favored α decay to ^{185}Tl (J=1/2+)														**
*^{189}Bi^n	J : M2 to 9/2-														**
^{190}Hf	−24800#	400#				600#	ms	>300ns	0^+	13	12Ku26	I	2012	β^- ?	
^{190}Ta	−28720#	200#				5.3	s	0.7	(3)	10	09Al30	TJD	2009	β^-=100	
^{190}W	−34370	40				30.0	m	1.5	0^+	20			1976	β^-=100	
^{190}W^m	−32630	40	1743.6	1.0		111	ns	17	8^+		10La16	ETJ	2010	IT=100	
^{190}W^n	−32530	40	1840.6	1.4		166	μs	6	10^-	20	10La16	ETJ	2000	IT=100	*
^{190}Re	−35583	5				3.0	m	0.2	$(2)^-$	20			1955	β^-=100	
^{190}Re^m	−35379	11	204	10		3.1	h	0.2	(6^-)	20	12Re19	E	1962	β^-=54.4 20;IT=45.6 20	
^{190}Os	−38707.8	0.6				STABLE		>12Ey	0^+	20			1931	IS=26.26 20;α ?	*
^{190}Os^m	−37002.1	0.6	1705.7	0.1		9.86	m	0.03	10^-	20	12Kr05	T	1950	IT=100	*
^{190}Ir	−36753.6	1.4				11.78	d	0.10	4^-	20			1947	β^+=100;e$^+$<0.002	
^{190}Ir^m	−36727.5	1.4	26.1	0.1		1.120	h	0.003	1^-	20			1964	IT=100	*
^{190}Ir^n	−36717.4	1.4	36.154	0.025		> 2	μs		4^+	20			1996	IT=100	
^{190}Ir^p	−36377.2	1.4	376.4	0.1		3.087	h	0.012	11^-	20			1950	β^+=91.4 2;IT=8.6 2	*
^{190}Pt	−37306.5	0.7				483	Gy	3	0^+	20	FGK209	T	1949	IS=0.012 2;α=100;2β^+ ?	
^{190}Au	−32834	3			*	42.8	m	1.0	1^-*	20			1959	β^+=100;α<1e-6	
^{190}Au^m	−32630#	150#	200#	150#	*	125	ms	20	11^-#	20			1982	IT≈100;β^+ ?	
^{190}Hg	−31371	16				20.0	m	0.5	0^+	20			1959	β^+=100;α ?	
^{190}Tl	−24366	7				2.6	m	0.3	2^-*	20	13Ba41	J	1970	β^+=100	*
^{190}Tl^m	−24296	5	70	7	MD	3.6	m	0.3	7^+*	20	13Ba41	J	1970	β^+=100	
^{190}Tl^n			*non − exist*		EU	750	μs	40	(8^-)	20			1981	IT=100	*
^{190}Tl^p	−24052	16	306	10	AD	60#	ms		(9^-)	20	91Va04	EJT	1991	IT=100	*
^{190}Pb	−20417	13				71	s	1	0^+	20			1972	β^+=99.60 4;α=0.40 4	
^{190}Pb^m	−17802	13	2614.8	0.8		150	ns	14	10^+	20	01Dr05	J	1998	IT=100	*
^{190}Pb^n	−17750#	50#	2665#	50#		24.3	μs	2.1	(12^+)	20			1998	IT=100	*
^{190}Pb^p	−17759	13	2658.2	0.8		7.7	μs	0.3	11^-	20	01Dr05	JT	1985	IT=100	*
^{190}Bi	−10596	21				6.3	s	0.1	(3^+)*	20	20An12	D	1972	α=77 21;β^+=23 21; β^+SF=6e-6 5	*
^{190}Bi^m	−10470	30	120	40	AD	6.2	s	0.1	10^-*	20	20An12	D	1988	α=70 9;β^+ ?;β^+SF=4e-6 3	*
^{190}Bi^n	−10475	26	121	15		175	ns	8	(5^-)		09An11	ET	2009	IT=100	*
^{190}Bi^p	−10200	50	394	40		1.3	μs	0.8	(8^-)	20	09An11	EJT	2001	IT=100	*
^{190}Po	−4563	13				2.45	ms	0.05	0^+	20			1996	α=100;β^+ ?	
*^{190}W^n	T : others 11St21=108(9) 09Al30=106(18)us 05Ca02=60(+1500-30)us 00Po26<3.1ms														**
*^{190}W^n	E : other 00Po26=2381														**
*^{190}Os	T : from 20Be23 for T1/2(α,0$^+$->2$^+$)														**
*^{190}Os^m	J : M2 + E3 to the 8+ member of the K=0+ gs band														**
*^{190}Ir^m	J : M3 to 4-; *l*(d,t)=1														**
*^{190}Ir^p	J : M4 to 7+; conf=p11/2[505]n11/2[615]; *log* ft=4.94 to ^{190}Os^m														**
*^{190}Ir^p	J : [J=10-], conf=n9/2[505]n11/2[615], consistent with														**
*^{190}Ir^p	J : n9/2[505]->p11/2-[505] transition														**
*^{190}Tl	J : also 92Me07=2														**
*^{190}Tl^m	J : also 92Me07=7														**
*^{190}Tl^n	I : introduced in 81Kr20, but not confirmed in 91Va04 and 05Xi06														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

$*^{190}$Tl^p E : 236(7) keV above ^{190}Tl^m **
$*^{190}$Tl^p T : from BM2=5.2(0.6)e-6 (W.u.) for a similar isomer in ^{188}Tl; other **
$*^{190}$Tl^p T : 91Va04>1 us **
$*^{190}$Pb^m T : uncertainty from 12Dr.A **
$*^{190}$Pb^n E : x keV above ^{190}Pb^m; x=50#(50#) **
$*^{190}$Pb^n T : uncertainty from 12Dr.A **
$*^{190}$Pb^p T : average 01Dr05=7.2(0.6) 85St16=7.9(0.4) **
$*^{190}$Bi D : %α symmetrized from 91Va04=90(+10-30)%; %β^+SF from T1/2(β^+SF) **
$*^{190}$Bi D : 20An12=2.8(+13.4-2.1)e7 s and T1/2 20An12=5.7(8)s **
$*^{190}$Bi J : 17Ba12=(3); favored α decay to J=3+ in ^{186}Tl **
$*^{190}$Bi T : other 13Ny01=7.7(+1.0-0.8) not used **
$*^{190}$Bi^m T : also 13Ny01=5.9(+1.0-0.8) not used **
$*^{190}$Bi^m J : 17Ba12=(10); favored α decay to ^{186}Tl^n (J=10-) **
$*^{190}$Bi^m D : %β^+SF from T1/2(β^+SF) 20An12=4.7(+22.6-3.5)e7 s and T1/2 20An12=5.9(6)s **
$*^{190}$Bi^n J : E1 and M1(+E2) gammas in cascade to (3+), absence of gamma to (3+) **
$*^{190}$Bi^n E : 45(15) + 76 keV above ^{190}Bi **
$*^{190}$Bi^p E : 274(1) keV above ^{190}Bi^m **
$*^{190}$Bi^p T : symmetrized from 09An11=1.0(+1.0-0.5) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{191}Ta	−26520#	300#				460#	ms	>300ns	$7/2^+$#	11	09St16	I	2009	β^- ?	
^{191}W	−31180	40				14#	s	>300ns	$3/2^-$#	07	99Be63	I	1999	β^- ?	
^{191}W^m	−30950#	40#	235#	10#		340	ns	14	$9/2^-$#		11St21	ETD	2009	IT=100	*
^{191}Re	−34350	10				9.8	m	0.5	$(3/2^+)$	07	97Hi06	J	1963	β^-=100	*
^{191}Re^m	−34205	10	145	3		20#	μs		$9/2^-$		FGK209	TIJ		IT ?	*
^{191}Re^n	−32749	10	1601.5	0.4		50.6	μs	3.5	$25/2^-$		16Re02	EJT	2011	IT=100	*
^{191}Os	−36395.2	0.7				14.99	d	0.02	$9/2^-$	07	12Kr05	T	1940	β^-=100	
^{191}Os^m	−36320.8	0.7	74.382	0.003		13.10	h	0.05	$3/2^-$	07	12Kr05	T	1952	IT=100	*
^{191}Ir	−36708.8	1.3				STABLE			$3/2^+*$	07			1935	IS=37.3 2	
^{191}Ir^m	−36537.5	1.3	171.29	0.04		4.899	s	0.023	$11/2^-$	07			1955	IT=100	*
^{191}Ir^n	−34607.8	1.6	2101.0	0.9		5.7	s	0.4	$31/2(^+)$	07	12Dr02	ETJ	1979	IT=100	*
^{191}Pt	−35698	4				2.83	d	0.02	$3/2^-*$	07			1948	ε=100	*
^{191}Pt^m	−35597	4	100.663	0.020		> 1	μs		$9/2^-$	07			1976	IT=100	*
^{191}Pt^n	−35549	4	149.035	0.022		95	μs	5	$13/2^+$	07			1967	IT=100	*
^{191}Au	−33798	5				3.18	h	0.08	$3/2^+*$	07			1954	β^+=100	
^{191}Au^m	−33532	5	266.2	0.7		920	ms	110	$11/2^-*$	07	20Ba17	J	1971	IT=100	
^{191}Au^n	−31308	5	2489.6	0.9		402	ns	20	$31/2^+$	07			1985	IT=100	*
^{191}Hg	−30592	22				49	m	10	$3/2^-*$	07			1954	β^+=100;α ?	
^{191}Hg^m	−30460	30	128	22		50.8	m	1.5	$13/2^+*$	07	01Sc41	E	1954	β^+=100;IT ?;α ?	*
^{191}Tl	−26283	7				20#	m		$1/2^+*$	07			1974	β^+ ?	*
^{191}Tl^m	−25986	7	297	7	BD	5.22	m	0.16	$9/2^-*$	07			1970	β^+=100	*
^{191}Pb	−20291	7				1.33	m	0.08	$3/2^-$	07	10Co13	JD	1974	$\beta^+\approx$100;α=0.51 5	*
^{191}Pb^m	−20234	8	58	10	AD	2.18	m	0.08	$13/2^+*$	07	17Al34	E	1975	$\beta^+\approx$100;$\alpha\approx$0.02	*
^{191}Pb^n	−17632	12	2659	10		180	ns	80	$33/2^+$	07	99La06	JT	1999	IT=100	*
^{191}Bi	−13239	7				12.4	s	0.3	$9/2^-*$	16			1972	α=51 10;β^+ ?	*
^{191}Bi^m	−12997	9	242	4	AD	125	ms	8	$1/2^+$	16			1981	α=68 5;IT ?;β^+ ?	*
^{191}Bi^n	−12809	7	429.7	0.5		562	ns	10	$13/2^+$	16	15Ny02	J	2001	IT=100	
^{191}Bi^p	−11364#	26#	1875#	25#		400	ns	40	$25/2^-$#	16			2016	IT=100	*
^{191}Po	−5069	7				22	ms	1	$3/2^-$	07			1993	$\alpha\approx$100;β^+ ?	*
^{191}Po^m	−5008	12	61	11	AD	93	ms	3	$13/2^+$	07			1999	$\alpha\approx$100;β^+ ?	*
^{191}At	3864	16				2.1	ms	0.8	$1/2^+$	07	03Ke08	T	2003	$\alpha\approx$100;β^+ ?	*
^{191}At^m	3922	18	58	20	AD	2.2	ms	0.4	$(7/2^-)$	07	03Ke08	T	2003	$\alpha\approx$100;β^+ ?	*

$*^{191}$W^m T : average 11St21=360(20) 09Al30=320(20) ns **
$*^{191}$Re J : measured (t,α) cross sections in 77Hi06 favor J=3/2 over 1/2 **
$*^{191}$Re^m IJ : M2 to 5/2+ at 97(3) keV; existence of a similar isomer in ^{187}Re **
$*^{191}$Re^m T : estimated from B(M2)=0.7 (W.u.) from ^{187}Re **
$*^{191}$Re^n T : other 11St21=77(33)us **
$*^{191}$Os^m T : other 12Kr05=13.6(0.2) from the decay growth, less accurate **
$*^{191}$Os^m J : M3 + E4 to 9/2- **
$*^{191}$Ir^m J : E3 to 5/2+ **
$*^{191}$Ir^n T : average 12Dr02=5.8(0.6) 79Lu01=5.5(0.7) **
$*^{191}$Ir^n E : from a least-squares fit to gamma-ray energies using data of 12Dr02 **
$*^{191}$Pt J : 92Hi07=3/2 **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{191}$Pt^m	J : E2 to 5/2-														**
$*^{191}$Pt^m	T : other 2 us, estimated from B(E2)=0.088(5) (W.u.) in ^{189}Pt														**
$*^{191}$Pt^n	J : M2 to 9/2-														**
$*^{191}$Au^n	J : E2 to 27/2+; measured magnetic moment														**
$*^{191}$Hg^m	E : original uncertainty (8 keV) increased by 20 keV for gs+m lines in trap														**
$*^{191}$Tl	J : 92Me07=1/2														**
$*^{191}$Tl^m	J : 13Ba41,12Ba32=9/2														**
$*^{191}$Pb	J : favored α decay to ^{187}Hg^m (J=3/2-)														**
$*^{191}$Pb	D : %α other 74Ho26=0.013(0.005)														**
$*^{191}$Pb^m	J : 91Du07=13/2														**
$*^{191}$Pb^n	E : 2602.31(0.24) above ^{191}Pb^m														**
$*^{191}$Pb^n	T : symmetrized from 99La06=150(+100-50)														**
$*^{191}$Bi	J : 17Ba12=(9/2); favored α decay to ^{187}Tl^m (J=9/2-)														**
$*^{191}$Bi^m	J : favored α decay to ^{187}Tl (J=1/2+)														**
$*^{191}$Bi^p	E : 1825.1 + x keV; x=50#(25#) keV														**
$*^{191}$Po	J : favored α decay to ^{187}Pb (J=3/2-)														**
$*^{191}$Po^m	J : favored α decay to ^{187}Pb^m (J=13/2+)														**
$*^{191}$At	T : symmetrized from 03Ke08=1.7(+1.1-0.5)														**
$*^{191}$At	J : favored α decay to ^{187}Bi^m (J=1/2+)														**
$*^{191}$At^m	T : symmetrized from 03Ke08=2.1(+0.4-0.3)														**
^{192}Ta	−23100#	400#				2.2	s	0.7	(2)	12	09Al30	T	2009	β^-=100;β^-n ?	
^{192}W	−29620#	200#				40#	s	>300ns	0^+	12			1999	β^- ?	
^{192}Re	−31590	70				15.4	s	0.5	(0^-)	12	20Wa.A	TJ	1965	β^-=100	*
^{192}Re^m	−31430	70	159	1		88	μs	8		12	11St21	ETD	2005	IT=100	*
^{192}Re^n	−31320	70	267	10		< 500	ms			12	20Wa.A	IT	2012	β^- ?;IT ?	*
^{192}Os	−35882.3	2.3				STABLE		>53Ey	0^+	12	13Be07	T	1931	IS=40.78 32;2β^- ?;α ?	*
^{192}Os^m	−33866.9	2.3	2015.40	0.11		5.94	s	0.09	10^-	12	13Dr05	J	1965	IT≈100;β^- ?	*
^{192}Os^n	−31302.0	2.5	4580.3	1.0		205	ns	7	(20^+)	12	13Dr05	ETJ	2004	IT=100	*
^{192}Ir	−34835.6	1.3				73.820	d	0.014	4^+*	12	FGK209	T	1937	β^-=95.24 4;ε=4.76 4	
^{192}Ir^m	−34778.9	1.3	56.720	0.005		1.45	m	0.05	1^-	12			1937	IT≈100;β^-=0.0175	
^{192}Ir^n	−34667.5	1.3	168.14	0.12		241	y	9	(11^-)	12			1959	IT=100	
^{192}Pt	−36288.5	2.6				STABLE		>60Py	0^+	12	11Be08	T	1935	IS=0.782 24;α ?	
^{192}Pt^m	−34116.1	2.6	2172.37	0.13		272	ns	23	10^-	12			1976	IT=100	*
^{192}Au	−32772	16				4.94	h	0.09	1^-*	12			1948	β^+=100	
^{192}Au^m	−32637	16	135.41	0.25		29	ms		5^+	12			1976	IT=100	*
^{192}Au^n	−32340	16	431.6	0.5		160	ms	20	11^-	12			1976	IT=100	*
^{192}Hg	−32011	16				4.85	h	0.20	0^+	12			1952	ε=100;α ?	
^{192}Tl	−25870	30				9.6	m	0.4	2^-*	12	13Ba41	J	1961	β^+=100	*
^{192}Tl^m	−25670	30	196	7		10.8	m	0.2	7^+*	12	13Ba41	J	1961	β^+=100	*
^{192}Tl^n	−25420	30	447	7		296	ns	5	(8^-)	12			1980	IT=100	*
^{192}Tl^p	−25695	25	180	40	AD				(3^+)	12	91Va04	E	1991	α=100	
^{192}Pb	−22552	6				3.5	m	0.1	0^+	12			1974	β^+≈100;α=0.0059 7	
^{192}Pb^m	−19971	6	2581.1	0.4		166	ns	6	10^+	12	07Io03	J	1985	IT=100	
^{192}Pb^n	−19927	6	2625.1	1.1		1.09	μs	0.04	12^+	12	07Io03	J	1979	IT=100	
^{192}Pb^p	−19809	6	2743.5	0.4		756	ns	14	11^-	12	07Io03	J	1991	IT=100	
^{192}Bi	−13530	30				34.6	s	0.9	$(3^+)*$	12			1971	β^+=88 5;α=12 5	*
^{192}Bi^m	−13398	9	140	30	MD	39.6	s	0.4	10^-*	12			1966	β^+=90 3;α=10 3	*
^{192}Po	−8066	11				32.2	ms	0.3	0^+	12			1977	α≈100;β^+ ?	
^{192}Po^m	−5771	11	2294.6	1.0		580	ns	100	11^-	12			1999	IT=100	*
^{192}At	2926	28			*&	11.5	ms	0.6	3^+#	12	13An03	D	2006	α=100;β^+ ?;β^+SF<0.51	*
^{192}At^m	2926	28	0	40	AD*&	88	ms	6	$(9^-,10^-)$	12	13An03	DT	2006	α=100;β^+ ?;β^+SF<0.51	*
$*^{192}$Re	T : average 20Wa.A=15.1(0.6) 12Al05=16(2) 79Ka.B=16(1)														**
$*^{192}$Re^m	T : average 11St21=85(10) 09Al30=93(15); other 05Ca02=120(+210-50)us														**
$*^{192}$Re^m	E : 159.3 keV gamma and X rays seen only in 11St21														**
$*^{192}$Re^n	T : not observed in 20Wa.A, based on the extraction time of the isotope														**
$*^{192}$Re^n	T : separation system; other 12Re19=61(+40-20) s for q=75+ (bare ions)														**
$*^{192}$Os	T : lower limit is for 2β^-; T1/2(α,0$^+$->2$^+$) 20Be23 >5.8Ey														**
$*^{192}$Os^m	T : average 79KaYT=5.9(0.1) 73Pa21=6.1(0.2); other 15Ak02=10.5(+1.0-0.9) s														**
$*^{192}$Os^m	T : from τ=15.1(+1.5-1.3) s for q=75+ (H-like)														**
$*^{192}$Os^n	T : from 13Dr05 τ=295(10) ns														**
$*^{192}$Pt^m	J : E2 to 8- band member														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{192}Au^m J : E3 to 2-; M2 to 3- **
*^{192}Au^n J : E3 to 8+ **
*^{192}Tl J : also 92Me07=2 **
*^{192}Tl^m J : also 92Me07=7 **
*^{192}Tl^m E : from 91Va04=168+x keV, 15 keV <x< 40 keV **
*^{192}Tl^n E : 250.6(0.2) keV above ^{192}Tl^m **
*^{192}Bi J : 17Ba12=(3) **
*^{192}Bi^m J : 17Ba12=(10); favored α decay to ^{188}Tl (J=10-) **
*^{192}Po^m J : E1 to 10+ **
*^{192}Po^m E : uncertainty estimated by the evaluator **
*^{192}At D : %β^+SF 13An03=0.42(0.09) for both isomers **
*^{192}At^m T : other 13An03=110(+26-18) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{193}Ta	−20810#	400#				220#	ms	>300ns	$7/2^+$#	17	12Ku26	I	2012	β^- ?;β^-n ?	
^{193}W	−26190#	200#				30#	s	>300ns	$1/2^-$#	17	09St16	I	2009	β^- ?	
^{193}Re	−30230	40				3#	m	>300ns	$5/2^+$#	17	99Be63	I	1999	β^- ?	
^{193}Re^m	−30080	40	146.0	0.2		69	μs	6	$(9/2^-)$	17	11St21	ETJ	2005	IT=100	*
^{193}Os	−33394.4	2.3				29.830	h	0.018	$3/2^-$	17			1940	β^-=100	
^{193}Os^m	−33078.8	2.3	315.6	0.3		121	ns	28	$(9/2^-)$	17			2011	IT=100	
^{193}Ir	−34536.3	1.3				STABLE			$3/2^+$*	17			1935	IS=62.7 2	
^{193}Ir^m	−34456.1	1.3	80.238	0.006		10.53	d	0.04	$11/2^-$	17			1957	IT=100	
^{193}Ir^n	−32257.4	1.4	2278.9	0.5		124.8	μs	2.1	$31/2^+$	17			2012	IT=100	
^{193}Pt	−34479.7	1.4				50	y	6	$1/2^-$*	17			1948	ε=100	*
^{193}Pt^m	−34329.9	1.4	149.78	0.04		4.33	d	0.03	$13/2^+$*	17	86Sc04	J	1949	IT=100	
^{193}Au	−33405	9				17.65	h	0.15	$3/2^+$*	17			1948	β^+=100;α ?	
^{193}Au^m	−33115	9	290.20	0.04		3.9	s	0.3	$11/2^-$*	17	20Ba17	J	1955	IT≈100;β^+≈0.03	
^{193}Au^n	−30918	9	2486.7	0.6		150	ns	50	$31/2^+$	17	07Ok05	J	1985	IT=100	
^{193}Hg	−31062	16				3.80	h	0.15	$3/2^-$*	17			1952	β^+=100	
^{193}Hg^m	−30921	16	140.76	0.05		11.8	h	0.2	$13/2^+$*	17			1973	β^+=92.8 5;IT=7.2 5	
^{193}Tl	−27477	7				21.6	m	0.8	$1/2^+$*	17			1960	β^+=100	
^{193}Tl^m	−27105	8	372	4		2.11	m	0.15	$9/2^-$*	17			1963	IT≈75;β^+≈25	*
^{193}Pb	−22229	10				4#	m		$3/2^-$#	17			1974	β^+= ?	*
^{193}Pb^m	−22137	7	93	12	AD	5.8	m	0.2	$13/2^+$*	17	17Al34	E	1974	β^+=100	*
^{193}Pb^n	−19522	16	2707	13		180	ns	15	$33/2^+$	17	04Io01	J	1991	IT=100	*
^{193}Bi	−15885	8				63.6	s	3.0	$9/2^-$*	17			1971	β^+=96.5 15;α=3.5 15	*
^{193}Bi^m	−15580	9	305	6	AD	3.20	s	0.14	$1/2^+$*	17	15He27	T	1970	α=84 16;β^+ ?	*
^{193}Bi^n	−15279	8	605.53	0.18		153	ns	10	$13/2^+$	17			2004	IT=100	
^{193}Bi^p	−13535	8	2349.6	0.6		85	μs	3	$29/2^+$	17			2004	IT=100	
^{193}Bi^q	−13480	8	2405.1	0.7		3.02	μs	0.08	$(29/2^-)$	17			2004	IT=100	
^{193}Po	−8325	15				399	ms	34	$3/2^-$*	17			1967	α≈100;β^+ ?	*
^{193}Po^m	−8225	15	100	6	AD	245	ms	11	$13/2^+$*	17			1981	α≈100;β^+ ?	*
^{193}At	−67	22			*	29	ms	5	$1/2^+$	17	03Ke08	T	2003	α≈100	*
^{193}At^m	−59	21	8	9	AD*	21	ms	5	$7/2^-$	17			1995	α≈100	*
^{193}At^n	−25	21	42	9	AD	28	ms	4	$13/2^+$	17	03Ke08	T	2003	IT=76 10;α=24 10	*
^{193}Rn	9043	25				1.15	ms	0.27	$(3/2^-)$	07			2006	α≈100	*

*^{193}Re^m E : average 05Ca02=146.1(0.3) 11St21=145.2(0.5) 09Al30=146.1(0.2) keV **
*^{193}Re^m T : average 11St21=65(9) 09Al30=72(8); other 05Ca02=75(+450-40) **
*^{193}Pt J : 92Hi07=1/2 **
*^{193}Tl^m E : 76Ha25<13 keV above 365.2-keV level due to negligible L Xray yield **
*^{193}Tl^m J : 13Ba41,12Ba32=9/2 **
*^{193}Pb T : 4.0 m reported in the Karlsruhe charts 1981 and 1995; not traceable **
*^{193}Pb^m J : 91Du07=13/2 **
*^{193}Pb^n E : 2612.5(0.5) keV above ^{193}Pb^m **
*^{193}Bi J : 16Ba42=9/2 **
*^{193}Bi^m J : 16Ba42=1/2 **
*^{193}Po J : 13Se03,14Se07=(3/2); favored α decay to ^{189}Pb (J=3/2-) **
*^{193}Po^m J : 13Se03,14Se07=(13/2); favored α decay to **
*^{193}Po^m J : ^{189}Pb^m (J=13/2+) **
*^{193}At T : symmetrized from 03Ke08=28(+5-4) **
*^{193}At J : favored α decay to ^{189}Bi^m (J=1/2+) **
*^{193}At^m J : favored α decay to ^{189}Bi (J=7/2-) **
*^{193}At^n T : symmetrized from 03Ke08=27(+4-3) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{193}At^n J : favored α decay to ^{189}Bi^n (J=13/2+) **
*^{193}Rn J : favored α decay to ^{189}Po [J=(3/2-)] **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{194}Ta	−17130#	500#				2#	s	>300ns		13	12Ku26	I	2012	β^- ?;β^-n ?	
^{194}W	−24410#	300#				20#	s	>300ns	0^+	11			2008	β^- ?	
^{194}Re	−27260#	200#				5	s	1	1^-#	14	12Al05	T	1999	β^-=100	*
^{194}Re^m	−27110#	210#	150#	50#		45	μs	18	4^-#	14	11St21	TD	2011	IT=100	*
^{194}Re^n	−26980#	200#	285	40		25	s	8	11^-#	14	12Re19	E	2012	β^-=100	*
^{194}Re^p	−26430#	200#	833	33		100	s	10		14	12Re19	E	2012	β^-=100	
^{194}Os	−32435.2	2.4				6.0	y	0.2	0^+	06			1951	β^-=100	
^{194}Ir	−32531.8	1.3				19.35	h	0.07	1^-*	06	16Kr06	T	1937	β^-=100	*
^{194}Ir^m	−32384.7	1.3	147.072	0.002		31.85	ms	0.24	4^+	06			1959	IT=100	
^{194}Ir^n	−32160	70	370	70	BD	171	d	11	(11^-)	06			1968	β^-=100	*
^{194}Pt	−34760.1	0.5				STABLE			0^+	06			1935	IS=32.864 410	
^{194}Au	−32211.9	2.1				38.02	h	0.10	1^-*	06			1948	β^+=100	
^{194}Au^m	−32104.5	2.2	107.4	0.5		600	ms	8	5^+	06			1975	IT=100	*
^{194}Au^n	−31736.1	2.2	475.8	0.6		420	ms	10	11^-	06			1953	IT=100	*
^{194}Hg	−32184.0	2.9				447	y	28	0^+	06	15Do01	T	1962	ε=100	*
^{194}Tl	−26937	14				33.0	m	0.5	2^-*	06	13Ba41	J	1960	β^+=100;α ?	*
^{194}Tl^m	−26677	4	260	14	MD	32.8	m	0.2	7^+*	06	13Ba41	J	1960	β^+=100	*
^{194}Pb	−24208	17				10.7	m	0.6	0^+	06			1960	β^+=100;α=7.3e-6 29	
^{194}Pb^m	−21580	17	2628.1	0.4		370	ns	13	12^+	06	FGK128	J	1972	IT=100	*
^{194}Pb^n	−21275	17	2933.0	0.4		133	ns	7	11^-	06			1986	IT=100	*
^{194}Bi	−16023	5				95	s	3	3^+*	06			1971	$\beta^+\approx$100;α=0.46 25	*
^{194}Bi^m	−15880	50	150	50	MD	125	s	2	$(6^+,7^+)$	06			1976	$\beta^+\approx$100;α ?	
^{194}Bi^n	−15860	5	163	4	AD	115	s	4	10^-*	06			1988	$\beta^+\approx$100;α=0.20 7	*
^{194}Po	−11005	13				392	ms	4	0^+	06			1967	$\alpha\approx$100;β^+ ?	
^{194}Po^m	−8692	13	2313.4	0.3		12.9	μs	0.5	(10^-)	06	16An10	TJE	1999	IT=100	
^{194}At	−716	24			*	286	ms	7	(5^-)	06	13An03	TD	2009	$\alpha\approx$100;β^+=8.3#; β^+SF=0.032#	*
^{194}At^m	−740	30	−20	40	AD*	323	ms	7	10^-	06	13An03	T	1984	$\alpha\approx$100;β^+=8.3#; β^+SF=0.032#	*
^{194}Rn	5725	17				780	μs	160	0^+	07			2006	$\alpha\approx$100;β^+ ?	

*^{194}Re T : other 09Ku28=1.0(0.5) withdrawn by authors in 14Ku23 **
*^{194}Re^m E : only 86.3 keV gamma is seen in 11St21 **
*^{194}Re^m I : assignment from 11St21; similar experiment, but with less statistics, **
*^{194}Re^m I : in 05Ca02 also reports a us isomer with 464, 148, 128 gammas **
*^{194}Re^m I : labeled in a singles spectrum, among others, on the top of high **
*^{194}Re^m I : background; the assignment of these gammas to ^{194}Re is ambiguous **
*^{194}Re^n T : associated with 194,349 and 554 keV gammas following β^- decay and **
*^{194}Re^n T : placed in 12Al05 in the high-spin part of ^{194}Os level scheme **
*^{194}Ir T : average 16Kr06=19.20(0.02) 72Ge10=19.15(0.03) 72Em01=19.41(0.01); **
*^{194}Ir T : Birge ratio=8.27 **
*^{194}Ir^n J : direct β^- feeding to J=10+ and no feeding to 8+ and 9-; systematics **
*^{194}Au^m J : M2 to 3- member of K=1- gs band **
*^{194}Au^n J : E3 to 8+ **
*^{194}Hg T : average 81Ho18=477(32) 79Pr15=358(55), values corrected in 15Do01 for **
*^{194}Hg T : the new branching intensity of the 328.5 keV gamma ray. **
*^{194}Tl J : also 92Me07=2 **
*^{194}Tl^m J : also 92Me07=7 **
*^{194}Pb^m J : E2 to 10+; magnetic moment **
*^{194}Pb^n J : E2 to 9-; magnetic moment **
*^{194}Bi J : 17Ba12=(3); favored α decay to ^{190}Tl (J=3+) **
*^{194}Bi^n J : 17Ba12=(10); favored α decay from ^{198}At^m (J=10-) **
*^{194}At T : 13An03, supersedes 09An11=253(10) **
*^{194}At D : %β^+SF 13An03=0.065(0.008) for both isomers **
*^{194}At J : favored α decay to ^{190}Bi^n [J=(5-)] **
*^{194}At^m T : 13An03=323(7), supersedes 09An11=310(8); other 13Ny01=300(+50-40) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{195}W	−20740#	300#				30#	s	>160ns	$3/2^-$#	16	12Ku26	I	2012	β^- ?	
^{195}Re	−25560#	300#				6	s	1	$5/2^+$#	14			2008	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{195}Os	−29510	60				6.5	m	1.1	(3/2−)	14	13Bi14	TD	2004	β^-=100	*
^{195}Os^m	−29080	60	427.8	0.3		47	s	3	(13/2+)	14	20Wa12	ETJ	2012	IT≈100;β^- ?	*
^{195}Ir	−31692.3	1.3				2.29	h	0.17	3/2+	14	13Bi14	TD	1952	β^-=100	
^{195}Ir^m	−31592	5	100	5		3.74	h	0.07	11/2−	14			1968	β^-≈100;IT ?	*
^{195}Ir^n	−29338	6	2354	6		4.4	μs	0.6	(27/2+)		11St21	ETJ	2011	IT=100	*
^{195}Pt	−32793.9	0.5				STABLE		>6.3Ey	1/2−*	14	11Be08	T	1935	IS=33.775 240;α ?	
^{195}Pt^m	−32534.8	0.5	259.077	0.023		4.010	d	0.005	13/2+*	14			1960	IT=100	
^{195}Au	−32567.1	1.1				186.01	d	0.06	3/2+*	14	14Un01	T	1948	ε=100	
^{195}Au^m	−32248.5	1.1	318.58	0.04		30.5	s	0.2	11/2−*	14	20Ba17	J	1952	IT=100	
^{195}Au^n	−30066#	20#	2501#	20#		12.89	μs	0.21	31/2(−)	14	13Dr01	ET	2013	IT=100	*
^{195}Hg	−31013	23				10.69	h	0.16	1/2−*	14	15Do01	T	1952	β^+=100	*
^{195}Hg^m	−30837	23	176.07	0.04		41.60	h	0.19	13/2+*	14	15Do01	T	1951	IT=54.2 20;β^+=45.8 20	*
^{195}Tl	−28155	11				1.16	h	0.05	1/2+*	14			1955	β^+=100	
^{195}Tl^m	−27672	11	482.63	0.17		3.6	s	0.4	9/2−*	14			1957	IT=100	*
^{195}Pb	−23738	5				15.0	m	1.4	3/2−	14			1957	β^+=100	*
^{195}Pb^m	−23535	5	202.9	0.7	IT	15.0	m	1.2	13/2+	14	91Gr12	E	1957	β^+=100; IT ?	
^{195}Pb^n	−21979	5	1759.0	0.7		10.0	μs	0.7	21/2−	14			1976	IT=100	
^{195}Pb^p	−20836	5	2901.7	0.8		95	ns	20	33/2+	14			1982	IT=100	
^{195}Bi	−18026	5				183	s	4	9/2−*	14			1971	β^+≈100;α=0.030 12	*
^{195}Bi^m	−17626	8	399	6	AD	87	s	1	1/2+*	14			1974	β^+=67 17;α=33 17	*
^{195}Bi^n	−15645	5	2381.0	0.5		614	ns	5	(29/2−)	14	17He12	EJT	2003	IT=100	*
^{195}Bi^p	−15410	5	2615.9	0.5		1.49	μs	0.01	29/2+	15	17He12	ETJ	2018	IT=100	*
^{195}Po	−11117	6				4.64	s	0.09	3/2−*	15			1967	α=94 4;β^+ ?	*
^{195}Po^m	−10968	7	148	9	MD	1.92	s	0.02	13/2+*	15	17Al34	EJ	1967	α≈100;β^+ ?;IT ?	*
^{195}At	−3470	10				290	ms	20	1/2+*	14			1999	α≈100;β^+ ?	*
^{195}At^m	−3441	8	29	7	AD	143	ms	3	7/2−*	14			1995	α=88 4;IT=12 4;β^+ ?	*
^{195}At^p	−3370#	40#	100#	40#					(13/2+)		13Uu01	J		IT ?	*
^{195}Rn	5050	50			*	7	ms	3	3/2−	14			2001	α=100	*
^{195}Rn^m	5131	17	80	50	AD*	6	ms	3	13/2+	14			2001	α=100	*

*^{195}Os J : E3 from (13/2+) and subsequent E2 to the ground state in 21Wa.B **
*^{195}Os^m T : other 12Re19=32(+154-16) m for q=76+ (bare ion) **
*^{195}Os^m E : from 21Wa.B,20Wa12=427.8(0.3); other 12Re19=454(10) keV **
*^{195}Ir^m T : average 68Ja06,73Ja10=3.67(0.08) 68Ho01=4.00(0.15) **
*^{195}Ir^m E : from 78Ya03,83Ci01=100(5) keV in ^{196}Pt(t,α); other **
*^{195}Ir^m E : 73Ja10=120(36) keV from β^- decay end-point energies **
*^{195}Ir^n E : 268.4,404.4,476.4,537.8,566.7 gammas in a cascade to ^{195}Ir^m **
*^{195}Pt J : 92Hi07=1/2 **
*^{195}Au^n E : 13Dr01=2460.9 + x; x=40#(20#) estimated by Nubase **
*^{195}Hg T : average 15Do01=10.84(0.03) 01Li17=10.53(0.03); Birge ratio B=7.3 **
*^{195}Hg^m T : average 15Do01=41.6(0.2) 73Vi09=41.6(0.8) **
*^{195}Tl^m J : 13Ba41,12Ba32=9/2 **
*^{195}Pb T : from 82Hi04, determined to be within 1.2 m of the ^{195}Pb^m **
*^{195}Pb T : half-life **
*^{195}Bi J : 16Ba42=9/2 **
*^{195}Bi D : %α from 85Co06=0.01-0.05 **
*^{195}Bi^m J : 16Ba42=1/2 **
*^{195}Bi^n E : uncertainty estimated by Nubase; other Esndf14=2395.5(0.5) **
*^{195}Bi^p E : uncertainty estimated by Nubase **
*^{195}Po J : 13Se03,14Se07,17Al34=(3/2);favored α decay to ^{191}Pb (J=3/2-) **
*^{195}Po^m J : 13Se03,14Se07,17Al34=(13/2); favored α decay to ^{191}Pb^m **
*^{195}Po^m J : (J=13/2+) **
*^{195}At J : 18Cu02=(1/2); favored α decay to ^{191}Bi^m (J=1/2+) **
*^{195}At^m E : Ensdf14=33.0(1.0) is erroneous **
*^{195}At^m J : 18Cu02=(7/2); favored α decay to ^{191}Bi (J=7/2-) **
*^{195}At^p E : estimated 70#(40#) above ^{195}At^m; 13Ny01<130 keV **
*^{195}Rn T : symmetrized from 01Uu01=6(+3-2) **
*^{195}Rn^m T : symmetrized from 01Uu01=5(+3-2) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{196}W	−18740#	400#				25#	s	>300ns	0+	13	12Ku26	I	2012	β^- ?	
^{196}Re	−22360#	300#				2.4	s	1.5		13			2008	β^- ?	*
^{196}Re^m	−22240#	300#	120#	40#		3.6	μs	0.6			11St21	T	2009	IT=100	*
^{196}Os	−28280	40				34.9	m	0.2	0+	17	77Ha32	T	1977	β^-=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{196}Ir	−29440	40				52.0	s	1.1	(1,2$^-$)	07	20Mu16	TJ	1966	β^-=100	*
^{196}Ir^m	−29227	20	210	40	BD	1.40	h	0.02	11$^-$#	07			1959	$\beta^-\approx$100;IT ?	
^{196}Pt	−32644.5	0.5				STABLE			0$^+$	07			1935	IS=25.211 340	
^{196}Au	−31138.7	3.0				6.165	d	0.011	2$^-$*	07	11Hi19	T	1937	β^+=93.0 3;β^-=7.0 3	*
^{196}Au^m	−31054	3	84.656	0.020		8.1	s	0.2	5$^+$	07			1971	IT=100	
^{196}Au^n	−30543	3	595.66	0.04		9.603	h	0.022	12$^-$*	07	20Mo24	T	1960	IT=100	
^{196}Hg	−31825.9	2.9				STABLE		>2.5Ey	0$^+$	07	90Bu28	T	1930	IS=0.15 1;2β^+ ?	
^{196}Tl	−27497	12				1.84	h	0.03	2$^-$*	07			1955	β^+=100	
^{196}Tl^m	−27103	12	394.2	0.5		1.41	h	0.02	7$^+$*	07	13Ba41	J	1960	β^+=96.2 4;IT=3.8 4	*
^{196}Pb	−25348	8				37	m	3	0$^+$	07			1957	β^+=100;α<3e-5	
^{196}Pb^m			*non−exist*		RN	< 1	μs		4$^+$	07			1973	IT=100	*
^{196}Pb^n	−23550	8	1797.51	0.14		140	ns	14	5$^-$	07			1973	IT=100	
^{196}Pb^p	−22653	8	2694.6	0.3		270	ns	4	12$^+$	07			1973	IT=100	
^{196}Bi	−18009	24				5.13	m	0.20	(3$^+$)	07	87Va09	T	1976	$\beta^+\approx$100;α=0.00115 34	*
^{196}Bi^m	−17843	25	166.4	2.9	AD	0.6	s	0.5	(7$^+$)	07			1987	IT$\approx$100;β^+ ?	
^{196}Bi^n	−17737	25	272	3	AD	4.00	m	0.05	(10$^-$)	07	87Va09	T	1987	β^+=74.2 25;IT=25.8 25; α=0.00038 10	*
^{196}Po	−13469	5				5.63	s	0.07	0$^+$	07	16Tr07	T	1967	α=94 5;β^+ ?	*
^{196}Po^m	−10975	5	2493.9	0.4		856	ns	17	11$^-$	07			1995	IT=100	
^{196}At	−3910	30			*	377	ms	4	(3$^+$)*	07	16Tr07	TD	1967	α=97.5 3;β^+ ?; β^+SF=0.009 1	*
^{196}At^m	−3950	18	−40	40	AD*	20#	ms		10$^-$#		96En01	DI	1996	$\alpha\approx$100	*
^{196}At^n	−3750	30	157.9	0.1		11	μs	2	(5$^+$)	07			2000	IT=100	
^{196}Rn	1975	14				4.7	ms	1.1	0$^+$	07	01Ke06	T	1995	$\alpha\approx$100;β^+ ?	*

*^{196}Re T : symmetrized from 14Ku23=3(+1-2) **
*^{196}Re^m E : E>72 keV (K-shell binding energy), since only K X-rays were observed **
*^{196}Os T : other 18Hi07=35.3(1.4) **
*^{196}Ir T : average 20Mu16=49(5) 68Ja06=54.5(2.0) 67Mo10=52(2) 66Vo05=50(2) **
*^{196}Au T : unweighted average 11Hi19=6.1451(0.0013) 01Li17=6.1669(0.0006) **
*^{196}Au T : 63Ik01=6.183(0.010); Birge ratio=10.86 **
*^{196}Tl J : also 92Me07=2 **
*^{196}Tl^m J : also 92Me07=7 **
*^{196}Pb^m T : this is the 4+ member of the ground-state band (K=0+) and the half-life **
*^{196}Pb^m T : is expected to be in the ps regime **
*^{196}Bi T : from 87Va09=308(12) s **
*^{196}Bi^n T : from 87Va09=240(3) s **
*^{196}Po T : average 16Tr07t=5.75(0.12) 97Pu01=5.5(0.1) 93Wa04=5.8(0.2); **
*^{196}Po T : others (not used) 10He25=4.1(+5.6-1.5) 05Uu02=5.1(+3.1-1.4) **
*^{196}Po D : %α from 93Wa04 **
*^{196}At D : %β^+SF other 93An11=0.088 **
*^{196}At T : average 16Tr07=371(5) 00Sm06=388(7) **
*^{196}At J : 18Cu02=(3) **
*^{196}At^m I : level not adopted in Ensdf2007 **
*^{196}Rn T : symmetrized from 01Ke06=4.4(+1.3-0.9) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{197}W	−14870#	400#				1#	s	>300ns	5/2$^-$#	13	12Ku26	I	2012	β^- ?	
^{197}Re	−20350#	300#				400#	ms	>300ns	5/2$^+$#	13			2009	β^- ?	
^{197}Os	−25080#	200#				93	s	7	5/2$^-$#	09	18Hi07	TD	2003	β^-=100	*
^{197}Os^m	−24580#	280#	500#	200#		< 0.1	s		13/2$^+$#		18Hi07	TI		IT ?;β^- ?	
^{197}Ir	−28264	20				5.8	m	0.5	3/2$^+$	05			1952	β^-=100	
^{197}Ir^m	−28149	21	115	5		8.9	m	0.3	11/2$^-$	05			1976	$\beta^-\approx$100;IT ?	
^{197}Ir^n	−26560#	500#	1700#	500#		30	μs	8			05Ca02	T	2005	IT=100	*
^{197}Ir^p	−25460#	500#	2800#	500#		15	μs	9			05Ca02	T	2005	IT=100	*
^{197}Pt	−30419.8	0.5				19.8915	h	0.0019	1/2$^-$*	05			1936	β^-=100	
^{197}Pt^m	−30020.2	0.5	399.59	0.20		95.41	m	0.18	13/2$^+$	05			1941	IT=96.7 4;β^-=3.3 4	
^{197}Au	−31139.8	0.5				STABLE			3/2$^+$*	05			1935	IS=100	
^{197}Au^m	−30730.7	0.5	409.15	0.08		7.73	s	0.06	11/2$^-$	05			1945	IT=100	
^{197}Au^n	−28607.3	1.1	2532.5	1.0		150	ns	5	27/2$^+$#		06Wh02	ETJ	2006	IT=100	
^{197}Hg	−30540	3				64.93	h	0.07	1/2$^-$*	05	20Le04	T	1941	ε=100	*
^{197}Hg^m	−30241	3	298.93	0.08		23.82	h	0.04	13/2$^+$*	05	20Le04	TD	1943	IT=94.68 9;ε=5.32 9	
^{197}Tl	−28354	14				2.84	h	0.04	1/2$^+$*	05			1955	β^+=100	
^{197}Tl^m	−27746	14	608.22	0.08		540	ms	10	9/2$^-$*	05			1953	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{197}Pb	−24745	5				8.1	m	1.7	$3/2^-$	05			1955	β^+=100	
^{197}Pb^m	−24426	5	319.31	0.11	IT	42.9	m	0.9	$13/2^+$*	05			1957	β^+=81 2;IT=19 2	*
^{197}Pb^n	−22831	5	1914.10	0.25		1.15	μs	0.20	$21/2^-$	05			1978	IT=100	
^{197}Bi	−19687	8				9.33	m	0.50	$9/2^-$*	05			1971	β^+=100;α ?	*
^{197}Bi^m	−19155	8	533	12	AD	5.04	m	0.16	$1/2^+$*	05			1966	α=55 40;β^+=45 40;IT ?	*
^{197}Bi^n			*non − exist*		RN	204	ns	18	$(23/2^-)$	05				IT=100	*
^{197}Bi^p	−17284	14	2403	12		263	ns	13	$(29/2^-)$	05	86Ch01	TJD	1986	IT=100	*
^{197}Bi^q	−16758	8	2929.5	0.5		209	ns	30	$(31/2^-)$	05	86Ch01	TJD	1986	IT=100	
^{197}Po	−13393	10				53.6	s	0.9	$(3/2^-)$*	05	93Wa04	T	1965	β^+ ?;α=44 7	*
^{197}Po^m	−13197	7	196	12	MD	25.8	s	0.1	$13/2^+$*	05	93Wa04	T	1967	α=84 9;β^+ ?;IT ?	*
^{197}At	−6355	8			*	388.2	ms	5.6	$9/2^-$*	05	05De01	T	1967	α=96.1 12;β^+=3.9 12	*
^{197}At^m	−6311	9	45	8	AD*	2.0	s	0.2	$1/2^+$*	05			1985	α≈100;β^+ ?;IT<0.004;β^+ ?	*
^{197}At^n	−6044	8	310.7	0.2		1.3	μs	0.2	$13/2^+$		08An11	ETJ	1999	IT=100	*
^{197}Rn	1510	16				54	ms	6	$3/2^-$	05	08An05	T	1995	α≈100;β^+ ?	*
^{197}Rn^m	1709	16	199	11	AD	25.6	ms	2.5	$13/2^+$	05	08An05	T	1996	α≈100;β^+ ?	*
^{197}Fr	10250	60				2.3	ms	1.9	$(7/2^-)$	14	13Ka16	TDJ	2013	α≈100	*

*^{197}Os T : average 18Hi07=91(8) from β^-(t) and 18Hi07=101(18) by gating on **
*^{197}Os T : β^--delayed 478.7 and 495.1 keV gammas **
*^{197}Ir^n E : 279, 379, 495, 567 keV gammas in 37-73 us time window in 05Ca02 **
*^{197}Ir^p E : 279,379,458,495,567,609 keV gammas in 0-37 us time window in 05Ca02 **
*^{197}Hg T : average 20Le04=64.81(0.24) 01Li17=64.94(0.07); Ensdf2005 includes **
*^{197}Hg T : 66El09=64.14(0.05) strongly conflicting, Birge ratio would be 6.7 **
*^{197}Tl^m J : 13Ba41,12Ba32=9/2 **
*^{197}Pb^m J : 91Du07=13/2 **
*^{197}Bi J : 16Ba42=9/2 **
*^{197}Bi^m J : 16Ba42=1/2 **
*^{197}Bi^n I : Ensdf2005 reported an isomer at 2129 keV, depopulating by 160.7 keV **
*^{197}Bi^n I : gamma; not trusted by Nubase, since the time spectrum for 160.7 keV **
*^{197}Bi^n I : gamma in 86Ch01 (fig.3) shows a significant prompt component **
*^{197}Bi^p T : other 95Zh36=252.6(38.7) outweighed, not used **
*^{197}Bi^p E : 95Zh36=2383.1 + x, with x<40 keV; 86Ch01=2360.4 + x is the same level **
*^{197}Bi^p E : but the authors mis-assigned the 97 keV gamma, see Fig.1 of 95Zh36 **
*^{197}Po T : average 93Wa04=53(1) 71Ho01=60(6) 67Le21=58(3) 67Si09=52(4); other not **
*^{197}Po T : used 96Ta18=84(16) **
*^{197}Po J : 13Se03,14Se07,17Al34=(3/2) **
*^{197}Po^m T : others not used 71Ho01=27(3) 67Le21=29(9) 67Si09=26(2) **
*^{197}Po^m T : 10He25=14.45(+14.45-4.9) ms for 3 events, strongly conflicting **
*^{197}Po^m J : 13Se03,14Se07,17Al34=(13/2); favored α decay to ^{193}Pb^m **
*^{197}Po^m J : (J=13/2+) **
*^{197}Po^m E : from 17Al34 **
*^{197}At T : average 05De01=390(16) 99Sm07=388(6); other 14Ka23=354(+17-15) **
*^{197}At J : 18Cu02=(9/2); favored α decay to ^{193}Bi (J=9/2-) **
*^{197}At^m T : other 14Ka23=2.8(+3.8-1.0) **
*^{197}At^m J : 18Cu02=(1/2); favored α decay to ^{193}Bi^m (J=1/2+) **
*^{197}At^n T : other 99Sm07=5.5(1.4) **
*^{197}At^n J : M2 to 9/2- **
*^{197}Rn T : symmetrized from 08An05=53(+7-5) **
*^{197}Rn J : favored α decay to ^{193}Po (J=3/2-) **
*^{197}Rn^m T : symmetrized from 08An05=25(+3-2); others 05Uu02=30(+150-15) **
*^{197}Rn^m T : 96En02=19(+8-4) 95Mo14=18(+9-5) **
*^{197}Rn^m J : favored α decay to ^{193}Po^m (J=13/2+) **
*^{197}Fr T : symmetrized from 13Ka16=0.6(+30-3) **

^{198}Re	−16990#	400#				1#	s	>300ns		16	09St16	I	2009	β^- ?;β^-n ?	*
^{198}Os	−23600#	200#				125	s	28	0^+	16	18Hi07	TD	2008	β^-=100	
^{198}Ir	−25710#	200#				8.7	s	0.4	1^-	16	20Mu16	TJ	1973	β^-=100	*
^{198}Pt	−29904.0	2.1				STABLE			0^+	16			1935	IS=7.356 130;2β^- ?;α ?	*
^{198}Au	−29580.8	0.5				2.69464	d	0.00014	2^-*	16	FGK209	T	1937	β^-=100	
^{198}Au^m	−29268.6	0.5	312.2227	0.0020		124	ns	4	5^+	16			1968	IT=100	
^{198}Au^n	−28768.9	1.6	811.9	1.5		2.272	d	0.016	12^-	16	FGK128	J	1972	IT=100	*
^{198}Hg	−30954.3	0.5				STABLE			0^+	16			1925	IS=10.04 3	
^{198}Tl	−27529	8				5.3	h	0.5	2^-*	16			1949	β^+=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{198}Tl^m	−26985	8	543.6	0.4		1.87	h	0.03	7^+*	16			1949	β^+=55.9 23;IT=44.1 23	
^{198}Tl^n	−26842	8	686.8	0.5		150	ns	40	$(5)^+$	16	77Kr04	EJT	1977	IT=100	
^{198}Tl^p	−26787	8	742.4	0.4		32.1	ms	1.0	10^-	16	FGK128	J	1975	IT=100	*
^{198}Pb	−26067	9				2.4	h	0.1	0^+	16			1955	β^+=100	
^{198}Pb^m	−23926	9	2141.4	0.4		4.12	μs	0.07	7^-	16	FGK128	J	1972	IT=100	*
^{198}Pb^n	−23836	9	2231.4	0.5		137	ns	10	9^-	16	FGK128	J	1989	IT=100	*
^{198}Pb^p	−23245	9	2821.7	0.6		212	ns	4	12^+	16	FGK128	J	1973	IT=100	*
^{198}Bi	−19374	28				10.3	m	0.3	3^+*	16	16Ly01	J	1950	β^+=100	
^{198}Bi^m	−19085	28	290	40	MD	11.6	m	0.3	7^+*	16	16Ly01	J	1992	β^+=100	
^{198}Bi^n	−18837	28	540	40	MD	7.7	s	0.5	10^-*	16			1972	IT=100	*
^{198}Po	−15473	17				1.760	m	0.024	0^+	16			1965	α=57 2;β^+=43 2	
^{198}Po^m	−12907	17	2565.92	0.20		200	ns	20	11^-	16			1990	IT=100	
^{198}Po^n	−12730#	50#	2740#	50#		750	ns	50	12^+	16	90Ma14	T	1990	IT=100	*
^{198}At	−6709	5				4.47	s	0.05	3^+*	16	19Gh11	T	1967	$\alpha\approx$97.0 17;β^+ ?	*
^{198}At^m	−6442	5	266.6	2.7	IT	1.23	s	0.05	10^-*	16	19Gh11	E	1967	α=93 4;β^+ ?	*
^{198}Rn	−1230	13				64.4	ms	1.6	0^+	16	95Bi17	T	1984	α=93 7;β^+ ?	*
^{198}Fr	9580	30			*	15	ms	3	3^+#	16	13Ka16	TD	2013	$\alpha\approx$100	
^{198}Fr^m	9580	40	0	50	AD*	1.1	ms	0.7	(10^-)	16	13Ka16	TD	2013	$\alpha\approx$100	*

*^{198}Re I : other 12Ku26>300 ns **
*^{198}Ir T : average 20Mu16=8.9(0.4) 14Ku23=8(2) 72ScYY=8(1) 73Sz03=8(3); others **
*^{198}Ir T : 18Hi07,18Mu.1=9.1(0.8), superseded by 18Hi07, 14Mo15=8(3), **
*^{198}Ir T : same as 14Ku23 **
*^{198}Pt T : 0nu-BB 52Fr23>320 Ty; α 11Be08>470Py **
*^{198}Au^n J : M4 to 8+; magnetic moment **
*^{198}Tl^p J : E3 to 7+ **
*^{198}Pb^m J : E2 to 5-; magnetic moment **
*^{198}Pb^m T : average 87Ca23=4.19(0.10) 18La03=4.05(0.10); others (not used) **
*^{198}Pb^m T : 72Is01=3.7(0.3) 73Dj01=4 92Wa20 5.3 **
*^{198}Pb^n J : E2 to 7- **
*^{198}Pb^p J : E2 to 10+; magnetic moment **
*^{198}Pb^p T : average 87Ca23=212(4) 83St15=211(10) 18La03=212(10); others (not used) **
*^{198}Pb^p T : 73Pa03=221(30) 86Ho03=240(20) **
*^{198}Bi^n E : from 92Hu04=248.5(0.5) keV above ^{198}Bi^m **
*^{198}Bi^n J : 17Ba12=(10); E3 to 7+ **
*^{198}Po^n E : 2691.86(0.20) + x keV; x=50#(50#) by Nubase **
*^{198}At J : 18Cu02=(3); favored α decay to ^{194}Bi (J=3+) **
*^{198}At D : %α from 95Bi.A>94 **
*^{198}At T : others 14Ka23=3.0(0.1) 12Fo09=4.2(2.0) 05Uu02=3.8(0.4) 92Hu04=4.2(0.3) **
*^{198}At T : 67Tr06=4.9(0.5) **
*^{198}At^m J : 18Cu02=(10); favored α decay from ^{202}Fr^m (J=10-) **
*^{198}At^m T : average 19Gh11=1.28(0.10) 14Ka23=1.24(0.06) 05Uu02=1.04(0.15); others **
*^{198}At^m T : 92Hu04=1.0(0.2) 67Tr06=1.5(0.3) **
*^{198}At^m D : %α from 95Bi.A>86 **
*^{198}Rn T : average 95Bi17=64(2) 90Ta30=66(+3-2) 84Ca32=50(9); others (not used) **
*^{198}Rn T : 14Ka23=34(+11-7) 05Uu02=22(+110-10) **
*^{198}Rn D : %α value quoted in 93Wa04 from a PhD thesis of M. Leino (1983) **
*^{198}Fr^m J : favored α decay to ^{194}At^m (J=10-) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{199}Re	−14730#	400#				250#	ms	>300ns	$5/2^+$#	13	12Ku26	I	2012	β^- ?	
^{199}Os	−20270#	200#				6	s	3	$5/2^-$#	07	14Ku23	T	2008	β^-=100	*
^{199}Ir	−24400	40				7	s	5	$3/2^+$#	07	14Ku23	T	1993	β^-=100	*
^{199}Pt	−27388.7	2.2				30.80	m	0.21	$5/2^-*$	07			1937	β^-=100	*
^{199}Pt^m	−26964.7	3.0	424	2		13.48	s	0.16	$13/2^+*$	07	18Mu.1	T	1959	IT=100	*
^{199}Au	−29093.8	0.5				3.139	d	0.007	$3/2^+$	07			1937	β^-=100	
^{199}Au^m	−28544.9	0.5	548.9405	0.0021		440	μs	30	$11/2^-$	07			1968	IT=100	*
^{199}Hg	−29546.1	0.5				STABLE			$1/2^-*$	07			1925	IS=16.94 12	
^{199}Hg^m	−29013.6	0.5	532.48	0.10		42.67	m	0.09	$13/2^+*$	07			1948	IT=100	
^{199}Tl	−28059	28				7.42	h	0.08	$1/2^+*$	07			1949	β^+=100	
^{199}Tl^m	−27310	28	748.87	0.06		28.4	ms	0.2	$9/2^-*$	07			1963	IT=100	
^{199}Pb	−25232	7				90	m	10	$3/2^-$	07			1950	β^+=100	
^{199}Pb^m	−24803	8	429.5	2.7		12.2	m	0.3	$(13/2^+)$	07			1955	IT$\approx$100;β^+= ?	*
^{199}Pb^n	−22668	8	2563.8	2.7		10.1	μs	0.2	$(29/2^-)$	07			1981	IT=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{199}Bi	−20798	11				27 m 1	$9/2^-$*	07			1950	β^+=100	
^{199}Bi^m	−20131	11	667	3	IT	24.70 m 0.15	$(1/2^+)$	07			1950	β^+=?;IT<2;$\alpha\approx$0.01	
^{199}Bi^n	−18836	25	1962	23		100 ns 30	$25/2^+$#	07			1974	IT=100	*
^{199}Bi^p	−18250	25	2548	23		168 ns 13	$29/2^-$#	07			1985	IT=100	*
^{199}Po	−15239	5				5.47 m 0.15	$3/2^-$*	07	13Se03	J	1965	β^+=92.5 3;α=7.5 3	*
^{199}Po^m	−14927	5	311.7	2.7	AD	4.17 m 0.05	$13/2^+$*	07			1964	β^+=73.5 10;α=24 1; IT=2.5 10	*
^{199}At	−8823	5				7.02 s 0.12	$9/2^-$*	07	05De01	T	1967	α=89 6;β^+ ?	*
^{199}At^m	−8579	5	244.0	1.0	IT	273 ms 9	$1/2^+$*		14Au03	TJD	2013	IT$\approx$99;$\alpha\approx$1	*
^{199}At^n	−8250	5	572.9	0.1		70 ns 20	$13/2^+$	07	10Ja05	ETJ	2000	IT=100	*
^{199}At^p	−6530	5	2293.4	0.5		800 ns 50	$(29/2^+)$		10Ja05	ETJ	2010	IT=100	
^{199}Rn	−1560	7				590 ms 30	$3/2^-$	07			1980	$\alpha\approx$100;β^+ ?	*
^{199}Rn^m	−1340	8	220	11	AD	310 ms 20	$13/2^+$	07			1981	$\alpha\approx$100;β^+ ?; IT ?	*
^{199}Fr	6771	14				6.6 ms 2.2	$1/2^+$#	07	13Ka16	T	1999	$\alpha\approx$100;β^+ ?	*
^{199}Fr^m	6817	10	45	13	AD	6.5 ms 0.9	$7/2^-$#		13Ka16	T	2013	$\alpha\approx$100;β^+ ?	*
^{199}Fr^n	7020#	50#	250#	50#		2.2 ms 1.2	$13/2^+$#		13Uu01	TDJ	2013	$\alpha\approx$100;β^+ ?	*

*^{199}Os T : symmetrized from 14Ku23,14Mo15=5(+4-2) **
*^{199}Ir T : symmetrized from 14Ku23,14Mo15=6(+5-4) **
*^{199}Pt J : 17Hi05=5/2 **
*^{199}Pt T : other 17Hi05=31.3(1.5) **
*^{199}Pt^m J : 17Hi05=(13/2); E3 to 7/2- **
*^{199}Pt^m T : average 18Mu.1=12.4(0.7) 17Hi05=14.3(1.4) 73Ur01=13.3(0.2) **
*^{199}Pt^m T : 59Wa15=14.1(0.3) **
*^{199}Au^m J : M2 to 7/2+; $l(^3He,d)$=5 **
*^{199}Pb^m E : 424.8(0.2) + x; x < 9.3 keV **
*^{199}Pb^n E : 2559.1(0.4) + x; x < 9.3 keV **
*^{199}Bi^n E : 1922.3 + x keV; x<80 keV in 85Pi05 **
*^{199}Bi^p E : 2523.2 + x keV; x<80 keV in 85Pi05 **
*^{199}Po J : 13Se03,14Se07=(3/2); favored α decay to ^{195}Pb (J=3/2-) **
*^{199}Po^m J : 13Se03,14Se07,17Al34=(13/2); favored α decay to ^{195}Pb^m **
*^{199}Po^m J : (J=13/2+) **
*^{199}At T : average 12Fo09=6.7(0.5) 05De01=6.92(0.13) 05Uu02=7.8(0.4) **
*^{199}At T : 67Tr06=7.2(0.5) **
*^{199}At J : 18Cu02=(9/2); favored α decay to ^{195}Bi (J=9/2-) **
*^{199}At D : %α symmetrized from 80Ew03=92(+3-8)% **
*^{199}At^m T : other 13Ja06=310(80) **
*^{199}At^m J : 18Cu02=(1/2); favored α decay to ^{195}Bi^m (J=1/2+) **
*^{199}At^m D : %α from 13Ja06~1 **
*^{199}At^n T : from $\gamma-\gamma$(t) by gating on gammas above and below the isomer; **
*^{199}At^n T : other 00La36=580(130)ns from recoil-time, probably includes decay of **
*^{199}At^n T : ^{199}At^p **
*^{199}Rn T : others 14Ka23=340(+280-110) **
*^{199}Rn J : favored α decay to ^{195}Po (J=3/2-) **
*^{199}Rn^m J : favored α decay to ^{195}Po^m (J=13/2+) **
*^{199}Fr T : average 13Ka16=4.5(+3.1-1.3) 99Ta20=12(+10-4) **
*^{199}Fr^m T : average 13Ka16=6.2(+1.1-0.8) 13Uu01=7(+3-2) **
*^{199}Fr^n T : symmetrized from 13Uu01=1.6(+1.6-.6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{200}Os	−18550#	300#				7 s 4	0^+	08	14Ku23	T	2005	β^-=100	*
^{200}Ir	−21570#	200#				43 s 6	$(2^-,3^-)$	11	14Mo15	T	2008	β^-=100;β^-n ?	*
^{200}Pt	−26599	20				12.6 h 0.3	0^+	07			1957	β^-=100	
^{200}Au	−27240	27				48.4 m 0.3	(1^-)	07			1951	β^-=100	
^{200}Au^m	−26233	26	1010	40	BD	18.7 h 0.5	12^-*	07			1968	β^-=84 1;IT=16 1	
^{200}Hg	−29503.3	0.5				STABLE	0^+	07			1925	IS=23.14 9	
^{200}Tl	−27047	6				26.1 h 0.1	2^-*	07			1949	β^+=100	
^{200}Tl^m	−26293	6	753.6	0.24		34.0 ms 0.9	7^+	07			1963	IT=100	
^{200}Tl^n	−26285	6	762.00	0.24		397 ns 17	5^+	07	19Ro12	T	1972	IT=100	
^{200}Pb	−26251	10				21.5 h 0.4	0^+	07			1950	ε=100	
^{200}Pb^m	−24068	10	2183.3	1.1		456 ns 6	(9^-)	07	18La03	T	1972	IT=100	
^{200}Pb^n	−23245	10	3005.8	1.2		198 ns 3	(12^+)	07	18La03	T	1975	IT=100	*
^{200}Bi	−20371	23			*	36.4 m 0.5	7^+*	07			1950	β^+=100	
^{200}Bi^m	−20270#	70#	100#	70#	*	31 m 2	(2^+)	07			1978	β^+<100;IT ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{200}Bi^{n}	−19943	23	428.20	0.10		400	ms	50	(10$^-$)	07			1972	IT=100	
^{200}Po	−16942	8				11.51	m	0.08	0$^+$	07			1951	β^+=88.9 3;α=11.1 3	
^{200}Po^{m}	−14346	8	2596.1	0.3		100	ns	10	11$^-$	07			1985	IT=100	
^{200}Po^{n}	−14125	11	2817	7		268	ns	3	12$^+$	07			1985	IT=100	*
^{200}At	−8988	24				43.2	s	0.9	(3$^+$)*	07	96Ta18	T	1963	α=52 3;β^+=48 3	*
^{200}At^{m}	−8875	25	112.9	2.9	AD	47	s	1	(7$^+$)*	07			1967	α=43 7;β^+=57 7;IT ?	*
^{200}At^{n}	−8644	25	343.8	3.0	AD	8.0	s	2.1	(10$^-$)*	07	05Uu02	T	1967	IT ?;$\alpha\approx$10.5 3;β^+ ?	*
^{200}Rn	−4000	6				1.09	s	0.16	0$^+$	07			1971	α=92 8;β^+ ?	*
^{200}Rn^{m}	−1680#	21#	2320#	20#		28	μs	9		07	02Do19	T	2002	IT=100	*
^{200}Fr	6130	30			*	47.5	ms	2.8	(3$^+$)	07	19Gh11	TD	1995	α=100;β^+ ?;β^+SF ?	*
^{200}Fr^{m}	6180	60	50	60	AD*	190	ms	120	10$^-$#		96En01	TD	1996	$\alpha\approx$100;IT ?	*
^{200}Fr^{n}	6280#	60#	150#	50#		790	ns	360			14Ka23	T	2014	IT ?	*

*^{200}Os T : symmetrized from 14Ku23,14Mo15=6(+4-3); other 05Ku.A=4.6(1.3) same group **
*^{200}Ir J : from 13Mo20=(2-,3-) **
*^{200}Pb^{m} T : average 73Pa04=480(30) 74Lu03=480(20) 78Mc03=480(60) 87Fa15=424(10) **
*^{200}Pb^{m} T : 88Pa12=480(20) 89Su12=480(30) 18La03=476(12); others (not used) **
*^{200}Pb^{m} T : 72Is01=540(30) 73Dj01 500 **
*^{200}Pb^{n} T : average 79Ma37=194(6) 87Fa15=202(5) 89Su12=199(5) 18La03=195(8); **
*^{200}Pb^{n} T : others (not used): 78Mc03=180(30) 88Pa12=152(30) 75Yo04=158(30) **
*^{200}Po^{n} E : 2804.5(0.6) +x; x<25 keV level **
*^{200}At T : average 96Ta18=44(2) 92Hu04=43(1) **
*^{200}At J : 18Cu02=(3) **
*^{200}At^{m} J : 18Cu02=(7) **
*^{200}At^{n} E : 230.9(0.2) keV above ^{200}At^{m} **
*^{200}At^{n} T : symmetrized from 05Uu02=7.3(+2.6-1.5) **
*^{200}At^{n} J : 18Cu02=(10) **
*^{200}Rn T : symmetrized from Ensdf2007=1.03(+0.20-0.11) **
*^{200}Rn D : %α symmetrized from 93Wa04=86(+14-4)% **
*^{200}Rn^{m} E : 2300.5(0.5) + x keV; x=20#(20#) keV **
*^{200}Rn^{m} T : symmetrized from 02Do19=25(+11-6) **
*^{200}Fr T : average 19Gh11=52(3) 14Ka23=46(4) 05De01=49(4) **
*^{200}Fr^{m} I : two events with 100 ms and E(a)=7550 keV correlated with E(a)=6880 keV **
*^{200}Fr^{m} I : assigned by evaluators to ^{196}At^{m} **
*^{200}Fr^{m} T : symmetrized from 84Sc13=100(+180-40) (2 events with T1/2=100 ms) **
*^{200}Fr^{n} E : 14Ka23=101.13 + x keV; x=50#(50#) keV by Nubase **
*^{200}Fr^{n} T : symmetrized from 14Ka23=600(+500-200) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{201}Os	−14840#	300#				3#	s	>300ns	1/2$^-$#	13			2009	β^- ?	
^{201}Ir	−19840#	200#				21	s	5	(3/2$^+$)	11	14Mo15	T	2008	β^-=100	*
^{201}Pt	−23740	50				2.5	m	0.1	(5/2$^-$)	07			1962	β^-=100	
^{201}Pt^{m}	−22890#	160#	850#	150#		10#	s		13/2$^+$#					IT ?	*
^{201}Au	−26401	3				26.0	m	0.8	3/2$^+$	07			1952	β^-=100	
^{201}Au^{m}	−25807	6	594	5		730	μs	630	11/2$^-$	07	11St21	T	1981	IT=100	*
^{201}Au^{n}	−24791	6	1610	5		5.6	μs	2.4	19/2$^+$#		11St21	ETD	2011	IT=100	*
^{201}Hg	−27662.5	0.7				STABLE			3/2$^-$*	07			1925	IS=13.17 9	
^{201}Hg^{m}	−26896.3	0.7	766.22	0.15		94.0	μs	2.0	13/2$^+$	07			1961	IT=100	
^{201}Tl	−27181	14				3.0421	d	0.0008	1/2$^+$*	07	FGK209	T	1950	ε=100	
^{201}Tl^{m}	−26262	14	919.16	0.21		2.01	ms	0.07	9/2$^-$	07			1962	IT=100	*
^{201}Pb	−25271	14				9.33	h	0.03	5/2$^-$*	07			1950	β^+=100	
^{201}Pb^{m}	−24642	14	629.1	0.3		60.8	s	1.8	13/2$^+$	07			1952	IT$\approx$100;β^+ ?	
^{201}Pb^{n}	−22318	24	2953	20		508	ns	3	(29/2$^-$)	07			1981	IT=100	*
^{201}Bi	−21429	12				103	m	3	9/2$^-$*	07			1950	β^+=100	
^{201}Bi^{m}	−20583	12	846.35	0.18		57.5	m	2.1	1/2$^+$	07			1950	$\beta^+\approx$100;α=?;IT ?	
^{201}Bi^{n}	−19456	26	1973	23		118	ns	28	25/2$^+$#	07			1982	IT=100	*
^{201}Bi^{p}	−19417	26	2012	23		105	ns	75	27/2$^+$#	07			1985	IT=100	*
^{201}Bi^{q}	−18648	26	2781	23		124	ns	4	29/2$^-$#	07			1982	IT=100	*
^{201}Po	−16521	5				15.6	m	0.1	3/2$^-$*	07			1951	β^+=98.87 3;α=1.13 3	*
^{201}Po^{m}	−16097	5	423.8	2.4	AD	8.96	m	0.12	13/2$^+$*	07			1962	IT=56.2 12;β^+=41.4 7; α=2.4 5	*
^{201}At	−10789	8				85.2	s	1.6	9/2$^-$*	07			1963	α=71 7;β^+=29 7	*
^{201}At^{m}	−10330	8	459	1		45	ms	3	1/2$^+$		14Au03	ETJ	2015	IT=100	
^{201}At^{n}	−8469	8	2319.7	0.3		3.39	μs	0.09	29/2$^+$		15Au01	ETJ	2015	IT=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{201}Rn	−4107	10				7.0	s	0.4	3/2−	07			1967	α=?;β^+ ?	*
^{201}Rn^m	−3863	7	245	12	AD	3.8	s	0.1	13/2+	07	17Al34	E	1967	α=?;β^+ ?	*
^{201}Fr	3589	9				62.8	ms	1.9	9/2−	07	14Ka23	TD	1980	$\alpha\approx$100;β^+ ?	*
^{201}Fr^m	3718	10	129	10	AD	24	ms	6	1/2+	07	20Au01	T	2005	α=100	*
^{201}Fr^n	3879	9	289.5	0.4		720	ns	40	13/2+		20Au01	ETJ	2014	IT=100	*
^{201}Ra	11937	20				20	ms	30	(3/2−)		14Ka23	TJ	2005	α=100	*
^{201}Ra^m	12200	26	263	26	AD	6	ms	5	13/2+	07	05Uu02	T	2005	α=100	*

*^{201}Ir J : 13Mo20=(1/2+,3/2+,5/2+), but 3/2+ agrees with systematics at Z=77 **
*^{201}Pt^m I : floating high-spin level populated in decay of high-spin isomer **
*^{201}Pt^m I : in 11St21; systematics of similar isomers in neighboring odd-N Pt **
*^{201}Pt^m I : nuclei **
*^{201}Au^m T : symmetrized from 11St21=340(+900-290) **
*^{201}Au^m J : $l(t,\alpha)$ in 81Fl05 **
*^{201}Au^n E : 378.2 keV + 638.0 keV gammas above ^{201}Au^m **
*^{201}Tl^m J : E3 to 3/2+ **
*^{201}Pb^n E : 2917.6(0.9) + x keV; x<70keV in 81He07 **
*^{201}Bi^n E : 1933.3(0.4) + x keV; x<80 keV in 85Pi05 **
*^{201}Bi^p E : 1972.3(0.4) + x keV; x<80 keV in 85Pi05 **
*^{201}Bi^q E : 2741.0(0.3) + x keV; x<80 keV in 85Pi05 **
*^{201}Po J : other 13Se03,14Se07=3/2 **
*^{201}Po^m J : 13Se03,14Se07=13/2 **
*^{201}At J : 18Cu02=(9/2); favored α decay to ^{197}Bi (J=9/2-) **
*^{201}Rn J : favored α decay to ^{197}Pb (J=3/2-) **
*^{201}Rn^m T : other 10He25=3.24(+3.24-1.08) ms **
*^{201}Rn^m J : favored α decay to ^{197}Pb^m (J=13/2+) **
*^{201}Fr T : average 14Ka23=64(3) 05Uu02=53(4) 05De01=67(3); others (not used) **
*^{201}Fr T : 96En01=69(+16-11) 80Ew03=48(15) **
*^{201}Fr J : favored α decay to ^{197}At (J=9/2-) **
*^{201}Fr^m T : average 20Au01=37(+14-8) 14Ka23=8(+12-3) 05Uu02=19(+19-6) **
*^{201}Fr^m J : favored α decay to ^{197}At^m (J=1/2+) **
*^{201}Fr^n T : other 14Ka23=700(+500-200) **
*^{201}Ra T : symmetrized from 14Ka23=8(+40-4) **
*^{201}Ra^m T : symmetrized from 05Uu02=1.6(+7.7-0.7) **
*^{201}Ra^m J : favored α decay to ^{197}Po^m (J=13/2+) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{202}Os	−12530#	400#				2#	s	>300ns	0+	13			2009	β^- ?	
^{202}Ir	−16640#	300#				11	s	3	(2−)	08	14Ku23	T	2008	β^-=100	*
^{202}Ir^m	−14040#	420#	2600#	300#		3.4	μs	0.6			11St21	TD	2011	IT=100	*
^{202}Pt	−22692	25				44	h	15	0+	08			1992	β^-=100	
^{202}Pt^m	−20904	25	1788.5	0.4		141	μs	7	(7−)	08	11St21	T	2005	IT=100	
^{202}Au	−24353	23				28.4	s	1.2	(1−)	08			1967	β^-=100	
^{202}Hg	−27345.3	0.7				STABLE			0+	08			1920	IS=29.74 13	
^{202}Tl	−25980.4	1.8				12.31	d	0.08	2−*	08			1940	ε=100	
^{202}Tl^m	−25030.2	1.8	950.19	0.10		591	μs	3	7+	08			1958	IT=100	
^{202}Pb	−25941	4				52.5	ky	2.8	0+	08			1954	ε=100	
^{202}Pb^m	−23771	4	2169.85	0.08		3.54	h	0.02	9−	08			1954	IT=90.5 5;β^+=9.5 5	
^{202}Pb^n	−21800#	50#	4140#	50#		100	ns	3	16+	08	19Ro12	T	1986	IT=100	*
^{202}Pb^p	−20640#	50#	5300#	50#		108	ns	3	19−	08	19Ro12	T	1987	IT=100	*
^{202}Bi	−20751	14				1.72	h	0.05	5+*	08			1951	β^+=100;α<1e-5	
^{202}Bi^m	−20126	18	625	12		3.04	μs	0.06	10−#	08			1981	IT=100	*
^{202}Bi^n	−18134	18	2617	12		310	ns	50	(17+)	08			1981	IT=100	*
^{202}Po	−17942	9				44.6	m	0.4	0+	08			1951	β^+=98.08 7;α=1.92 7	
^{202}Po^m	−16230	15	1712	12		110	ns	15	8+	08			1971	IT=100	*
^{202}At	−10595	28				184	s	1	3+*	08	16Ly01	JD	1961	β^+=88 7;α=12 7	*
^{202}At^m	−10401	28	190	40	MD	182	s	2	7+*	08	16Ly01	JD	1992	β^+=91.5 15;α=8.5 15;IT ?	*
^{202}At^n	−10010	28	590	40	MD	460	ms	50	10−	08	16Ly01	J	1992	IT=99.904 11;α=0.096 11; β^+ ?	*
^{202}Rn	−6275	18				9.7	s	0.1	0+	08			1967	α=78 8;β^+ ?	
^{202}Rn^m	−3970#	50#	2310#	50#		2.22	μs	0.07	11−#		02Do19	T	2002	IT=100	
^{202}Fr	3102	6				372	ms	12	3+*	08	14Ka23	T	1980	$\alpha\approx$100;β^+ ?	*
^{202}Fr^m	3359	6	257	6	AD	286	ms	13	10−*	08	14Ka23	T	1980	$\alpha\approx$100;IT=?;β^+ ?	*
^{202}Ra	9075	15				4.1	ms	1.1	0+	08	14Ka23	T	2005	α=100	*

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*^{202}Ir T : 14Ku23=11(3) supersedes 14Mo15=15(3) **
*^{202}Ir^m E : 311.5, 655.9, 737.2, 889.2, 967.6 gamma rays seen in decay and by **
*^{202}Ir^m E : assuming that 655.9 and 967.6 depopulate the same level **
*^{202}Pb^n E : 4091.0(0.7) + x keV; x=50#(50#) keV by Nubase **
*^{202}Pb^n T : average 19Ro12=93(4) 86Ja13=110(5) 18La03=103(10) **
*^{202}Pb^p E : 5251.0(0.5) + x keV; x=50#(50#) keV by Nubase **
*^{202}Pb^p T : average 19Ro12=113(6) 87Fa15=107(3) 18La03=105(38) **
*^{202}Bi^m E : 605 + x keV; x<40 keV in 81Th03 **
*^{202}Bi^n E : 2597.07(0.25) + x keV; x<40 keV in 81Th03 **
*^{202}Po^m E : 1691.5(0.4) + x keV; x<40 keV in 76Be12 **
*^{202}At J : 18Cu02=(3);favored α decay to ^{198}Bi (J=3+) **
*^{202}At^m J : 18Cu02=(7);favored α decay to ^{198}Bi^m (J=7+) **
*^{202}At^n E : from 92Hu04=391.7(0.5) keV above ^{202}At^m **
*^{202}At^n J : also favored α decay to ^{198}Bi^n (J=10-) **
*^{202}Fr J : 13Fl09=3, 14Ly01=(3) **
*^{202}Fr^m J : 13Fl09=10, 14Ly01=(10) **
*^{202}Fr^m D : IT reported in 81Ri04 **
*^{202}Ra T : symmetrized from 14Ka23=3.8(+1.3-0.8); others 05Uu02=16(+30-7) **
*^{202}Ra T : 96Le09=0.7(+3.3-0.3) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{203}Os	−7270#	400#				300#	ms	>300ns	$9/2^+$#	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{203}Ir	−14370#	400#				7#	s	>300ns	$3/2^+$#	13	09St16	I	2009	β^- ?	
^{203}Ir^m	−14170#	400#	200#	50#		> 100#	ns		$11/2^-$#		11St21	IJ		IT ?;β^- ?	*
^{203}Ir^n	−12230#	400#	2140#	50#		798	ns	350	$(23/2^+)$		11St21	TJD	2011	IT=100	*
^{203}Pt	−19510#	200#				22	s	4	$(1/2^-)$	06	14Mo15	T	2008	β^-=100	*
^{203}Pt^m	−18140#	200#	1367#	3#		12	s	5	$13/2^+$#	06	14Mo15	T	2008	$\beta^-\approx$100; IT ?	*
^{203}Pt^n	−18090#	210#	1420#	50#		> 100#	ns		$27/2^-$#	06	11St21	IJ	2008	IT=100	
^{203}Pt^p	−16980#	210#	2530#	50#		641	ns	55	$33/2^+$#		11St21	TJD	2011	IT=100	
^{203}Au	−23143	3				60	s	6	$3/2^+$	05			1952	β^-=100	
^{203}Au^m	−22502	4	641	3		140	μs	44	$11/2^-$#	05	11St21	TJ	2005	IT=100	
^{203}Hg	−25269.2	1.6				46.610	d	0.010	$5/2^-$*	05	FGK204	T	1943	β^-=100	
^{203}Hg^m	−24336.1	1.6	933.14	0.23		22.1	μs	1.0	$(13/2^+)$	05	11St21	T	1964	IT=100	*
^{203}Hg^n	−16987.9	1.7	8281.3	0.5		146	ns	30	$(53/2^+)$		11Sz01	EJT	2011	IT=100	
^{203}Tl	−25761.3	1.2				STABLE			$1/2^+$*	05			1931	IS=29.515 44	*
^{203}Tl^m	−24277.6	1.5	1483.7	0.9		< 1	μs		$(9/2^-)$		20Fo05	ETJ	2020	IT=100	*
^{203}Tl^n	−22200#	50#	3565#	50#		7.7	μs	0.5	$(25/2^+)$	05			1998	IT=100	*
^{203}Pb	−24786	7				51.924	h	0.015	$5/2^-$	05	14Un01	T	1942	ε=100	*
^{203}Pb^m	−23961	7	825.2	0.3		6.21	s	0.08	$13/2^+$	05			1955	IT=100	
^{203}Pb^n	−21837	7	2949.2	0.4		480	ms	7	$29/2^-$	05			1977	IT=100	
^{203}Pb^p	−21820#	50#	2970#	50#		122	ns	4	$25/2^-$#	05			1988	IT=100	*
^{203}Bi	−21525	13				11.76	h	0.05	$9/2^-$*	05			1950	β^+=100	
^{203}Bi^m	−20427	13	1098.21	0.09		305	ms	5	$1/2^+$	05			1984	IT=100	
^{203}Bi^n	−19484	13	2041.5	0.6		194	ns	30	$25/2^+$	05			1978	IT=100	
^{203}Po	−17311	5				36.7	m	0.5	$5/2^-$*	05			1951	β^+=99.89 2;α=0.11 2	*
^{203}Po^m	−16669	5	641.68	0.14		45	s	2	$13/2^+$*	05	13Se03	J	1969	IT$\approx$100;α ?	*
^{203}Po^n	−15153	5	2158.5	0.6		> 200	ns			05			1986	IT=100	
^{203}At	−12163	11				7.4	m	0.2	$9/2^-$*	05			1951	β^+=69 3;α=31 3	*
^{203}At^m	−11480	11	683.4	0.3		3.5	ms	0.6	$1/2^+$		17Au05	ETJ	2017	IT=100	
^{203}At^n	−9833	11	2330.1	0.4		9.77	μs	0.21	$29/2^+$		18Au01	ETJ	2018	IT=100	
^{203}Rn	−6184	6				44.2	s	1.6	$3/2^-$	05			1967	α=66 9;β^+=34 9	*
^{203}Rn^m	−5822	5	362	4	AD	26.9	s	0.5	$13/2^+$*	05	87Bo29	J	1967	α=75 10;β^+=25 10	
^{203}Fr	876	6				550	ms	10	$9/2^-$*	05			1967	$\alpha\approx$100;β^+ ?	*
^{203}Fr^m	1237	7	361	6		43	ms	4	$1/2^+$		13Ja06	TJD	2013	IT=80 4;α=20 4	*
^{203}Fr^n	1302	6	426.0	1.0		370	ns	50	$13/2^+$		13Ja06	TJD	2013	IT=100	
^{203}Ra	8601	10				36	ms	13	$3/2^-$	05	96Le09	J	1996	$\alpha\approx$100;β^+ ?	*
^{203}Ra^m	8848	10	246	14	AD	25	ms	5	$13/2^+$	05	96Le09	J	1996	$\alpha\approx$100;β^+ ?	*

*^{203}Ir^m I : floating high-spin level populated in decay of ^{203}Ir^n **
*^{203}Ir^m I : in 11St21; systematics of similar isomers in neighboring odd-Z Ir **
*^{203}Ir^m I : nuclei **
*^{203}Ir^n E : 207.0, 841.3, 894.7 gammas in a cascade to ^{203}Ir^m **
*^{203}Pt J : from 13Mo20=(1/2-) **
*^{203}Pt^m E : estimated from 13Mo20 **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{203}Hg^m	T : average 11St21=21.9(1.0) 86Ze03=27(5) 64Br27=21(5)														**
*^{203}Tl	J : other 13Ba41=1/2														**
*^{203}Tl^m	T : not directly measured; half-life expected ∼2-20 ns														**
*^{203}Tl^n	E : 3514.6 + x keV; x=50#(50#) keV by Nubase														**
*^{203}Pb	T : average 14Un01=51.92(0.04) 01Li17=51.99(0.03) 80Ho17=51.88(0.02)														**
*^{203}Pb	T : 71Ch54=52.02(0.05)														**
*^{203}Pb^p	E : 2923.4(0.7) + x keV; x=50#(50#) keV by Nubase														**
*^{203}Po	J : other 13Se03,14Se07,17Al34=3/2														**
*^{203}Po^m	J : 13Se03,14Se07=13/2														**
*^{203}At	J : 18Cu02=9/2														**
*^{203}Rn	T : average 96Ta18=42(3) 71Ho01=45(2) 67Va17=45(5)														**
*^{203}Rn	J : favored a-decay to ^{199}Po (J=3/2-)														**
*^{203}Fr	J : 17Wi11,13Fl09=9/2,14Ly01=(9/2)														**
*^{203}Fr^m	J : favored α decay to ^{199}At^m (J=1/2+)														**
*^{203}Ra	T : symmetrized from 05Uu02=31(+17-9); others 14Ka23=50(+40-15)														**
*^{203}Ra	T : 96Le09=1.1(+5.0-0.5)														**
*^{203}Ra	J : favored α decay to ^{199}Rn^m (J=3/2-)														**
*^{203}Ra^m	T : symmetrized from 05Uu02=24(+6-4); others 14Ka23=37(+37-12)														**
*^{203}Ra^m	T : 96Le09=33(+22-10)														**
*^{203}Ra^m	J : favored α decay to ^{199}Rn^m (J=13/2+)														**
^{204}Ir	−9570#	400#				2#	s	>300ns		13	11Mo18	I	2011	β^- ?;β^-n ?	
^{204}Pt	−17620#	200#				10.3	s	1.4	0$^+$	10			2008	β^-=100	*
^{204}Pt^m	−15630#	200#	1995.1	0.7		5.5	μs	0.7	(5$^-$)	10	11St21	E	2009	IT=100	*
^{204}Pt^n	−15590#	200#	2035	23		55	μs	3	(7$^-$)	10			2009	IT=100	*
^{204}Pt^p	−14430#	200#	3193	23		146	ns	14	(10$^+$)	10			2009	IT=100	*
^{204}Au	−20390#	200#				38.3	s	1.3	(2$^-$)	10	14Mo15	T	1972	β^-=100	*
^{204}Au^m	−16570#	540#	3816#	500#		2.1	μs	0.3	16$^+$#	10	11St21	JD	2008	IT=100	*
^{204}Hg	−24690.1	0.5				STABLE			0$^+$	10			1920	IS=6.82 4;2β^- ?	
^{204}Hg^n	−17464.0	0.5	7226.08	0.17		∼485	ns		22$^+$		15Wr02	ETJ	2015	IT=100	
^{204}Tl	−24346.1	1.2				3.783	y	0.012	2$^-$*	10			1953	β^-=97.08 7;ε+β^+=2.92 7	
^{204}Tl^m	−23242.0	1.2	1104.1	0.2		61.7	μs	1.0	7$^+$	10	11Br12	EJ	1972	IT=100	
^{204}Tl^n	−22027.1	1.2	2319.0	0.3		2.6	μs	0.2	12$^-$	10	11Br12	EJ	1998	IT=100	
^{204}Tl^p	−19954.5	1.3	4391.6	0.5		420	ns	30	18$^+$	10	11Br12	ETJ	1998	IT=100	
^{204}Tl^q	−18106.7	1.3	6239.4	0.5		90	ns	3	22$^-$	10	11Br12	ETJ	2011	IT=100	
^{204}Pb	−25109.8	1.1				STABLE		>140Py	0$^+$	10			1932	IS=1.4 6;α ?	*
^{204}Pb^m	−23835.7	1.1	1274.13	0.05		265	ns	6	4$^+$	10			1963	IT=100	
^{204}Pb^n	−22923.9	1.1	2185.88	0.08		66.93	m	0.10	9$^-$	10			1956	IT=100	
^{204}Pb^p	−22845.4	1.1	2264.42	0.06		490	ns	70	7$^-$	10			1978	IT=100	*
^{204}Bi	−20646	9				11.22	h	0.10	6$^+$*	10			1947	β^+=100	
^{204}Bi^m	−19841	9	805.5	0.3		13.0	ms	0.1	10$^-$	10			1974	IT=100	
^{204}Bi^n	−17813	9	2833.4	1.1		1.07	ms	0.03	17$^+$	10			1974	IT=100	
^{204}Po	−18341	10				3.519	h	0.012	0$^+$	10			1951	β^+=99.33 3;α=0.67 3	
^{204}Po^m	−16702	10	1639.03	0.06		158.6	ns	1.8	8$^+$	10	10Ka29	T	1970	IT=100	*
^{204}At	−11875	23				9.12	m	0.11	7$^+$*	10			1961	β^+=96.2 2;α=3.8 2	*
^{204}At^m	−11288	23	587.30	0.20		108	ms	10	10$^-$	10			1969	IT=100	
^{204}Rn	−7970	7				1.242	m	0.023	0$^+$	10			1967	α=72.4 9;β^+ ?	
^{204}Fr	607	25				1.75	s	0.26	3$^+$*	10	95Bi.A	D	1964	α=96 2;β^+ ?	*
^{204}Fr^m	658	25	50	4	AD	2.41	s	0.19	7$^+$*	10	95Bi.A	D	1967	α=90 2;β^+ ?	*
^{204}Fr^n	934	25	326	4	AD	1.65	s	0.15	10$^-$*	10	13Ja06	T	1992	α=53 10;IT=47 10	*
^{204}Ra	6061	9				60	ms	9	0$^+$	10	05Uu02	T	1995	$\alpha\approx$100;β^+ ?	*
*^{204}Pt	T : other 14Mo15=16(+6-5)														**
*^{204}Pt^m	E : 872.4(0.5),1122.7(0.5) gammas in a cascade to 0+														**
*^{204}Pt^n	E : 1995.1(0.7) + x keV; x < 80 keV														**
*^{204}Pt^p	E : 1157.5(0.5) gamma to ^{204}Pt^n														**
*^{204}Au	T : average 14Mo15=37.2(0.8) 84Cr01=39.8(0.9); others 17Ca12=33.7(14.9)														**
*^{204}Au	T : 72Pa06=40(3)														**
*^{204}Au^m	E : 839.0, 976.6 gammas in a cascade to 12-# estimated at 2000#(500#) keV														**
*^{204}Pb	T : also 13Be16>140Ey														**
*^{204}Pb^p	T : symmetrized from 78So02=450(+100-30)														**
*^{204}Po^m	T : average 10Ka29=161(4) 87Ra04=158(2); others 90Fa03=150(10)														**
*^{204}Po^m	T : 83He08=150(10) 71Ha01=140(5) 70Ya03=190(20) 70Br.A=143(5)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{204}At T : other 10Ka29=9.6(2) **
*^{204}At J : 18Cu02=(7) **
*^{204}Fr T : average 05Uu02=1.9(0.5) 92Hu04=1.7(0.3) **
*^{204}Fr J : 15Vo05,14Ly01,13Vo10=3 **
*^{204}Fr^m T : average 13Ja06=2.6(0.3) 05Uu02=1.6(+0.5-0.3) 92Hu04=2.6(0.3) **
*^{204}Fr^m J : 15Vo05,14Ly01=7 **
*^{204}Fr^n E : 276.1 keV above ^{204}Fr^m from 95Bi.A **
*^{204}Fr^n T : 13Ja06=1.65(0.15) supersedes 05Uu02=0.8(0.2) (same group) **
*^{204}Fr^n J : 15Vo05=10,14Ly01=(10) **
*^{204}Fr^n D : %α from 14Ly01; other (not used) 94Le05=1.4(+0.8-0.4) **
*^{204}Ra T : average 05Uu02=54(+19-11) 96Le09=59(+12-9); other 10He25=44(+44-15) **
*^{204}Ra T : 95Le04=45(+55-21) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{205}Ir	−5600#	500#			1# s	>300ns	$3/2^+$#	20	12Ku26	I	2012	β^- ?;β^-n ?	
^{205}Pt	−12820#	300#			2# s	>300ns	$9/2^+$#	20			2009	β^- ?	
^{205}Au	−18570#	200#			32.0 s	1.4	$3/2^+$#	20			1994	β^-=100	
^{205}Au^m	−17660#	200#	907	5	6 s	2	$11/2^-$#	20			2009	IT=?;β^-=?	
^{205}Au^n	−15720#	200#	2849.7	0.4	163 ns	5	$19/2^+$#	20			2011	IT=100	
^{205}Hg	−22288	4			5.14 m	0.09	$1/2^-$*	20			1940	β^-=100	*
^{205}Hg^m	−20732	4	1556.4	0.3	1.09 ms	0.04	$13/2^+$	20			1985	IT=100	
^{205}Hg^n	−18971	4	3316.6	0.8	5.89 μs	0.18	$(23/2^-)$	20			2011	IT=100	
^{205}Tl	−23820.8	1.2			STABLE		$1/2^+$*	20			1931	IS=70.485 44	*
^{205}Tl^m	−20530.2	1.2	3290.61	0.17	2.6 μs	0.2	$25/2^+$	20			1976	IT=100	
^{205}Tl^n	−18985.2	1.9	4835.6	1.5	235 ns	10	$(35/2^-)$	20			2004	IT=100	
^{205}Pb	−23770.2	1.1			17.0 My	0.9	$5/2^-$	20			1954	ε=100	
^{205}Pb^m	−23767.9	1.1	2.329	0.007	24.2 μs	0.4	$1/2^-$	20			1994	IT=100	
^{205}Pb^n	−22756.4	1.1	1013.85	0.03	5.55 ms	0.02	$13/2^+$	20			1960	IT=100	
^{205}Pb^p	−20574.4	1.3	3195.8	0.6	217 ns	5	$25/2^-$	20			1973	IT=100	
^{205}Bi	−21066	5			14.91 d	0.07	$9/2^-$*	20			1951	β^+=100	
^{205}Bi^m	−19569	5	1497.17	0.09	7.9 μs	0.7	$1/2^+$	20			1972	IT=100	
^{205}Bi^n	−19001	5	2064.7	0.4	100 ns	6	$21/2^+$	20			1978	IT=100	
^{205}Bi^p	−18927	5	2139.0	0.7	220 ns	25	$25/2^+$	20			1978	IT=100	
^{205}Po	−17521	10			1.74 h	0.08	$5/2^-$*	20			1951	β^+=99.960 12;α=0.040 12	
^{205}Po^m	−17378	10	143.166	0.015	310 ns	60	$1/2^-$	20			1960	IT=100	
^{205}Po^n	−16641	10	880.31	0.04	645 μs	20	$13/2^+$	20			1962	IT=100	
^{205}Po^p	−16060	10	1461.21	0.21	57.4 ms	0.9	$19/2^-$	20			1973	IT=100	
^{205}Po^q	−14434	10	3087.2	0.4	115 ns	10	$29/2^-$	20			1985	IT=100	
^{205}At	−12985	12			26.9 m	0.8	$9/2^-$*	20			1951	β^+=90 2;α=10 2	*
^{205}At^m	−10645	12	2339.64	0.23	7.76 μs	0.14	$29/2^+$	20			1982	IT=100	
^{205}Rn	−7710	5			170 s	4	$5/2^-$*	20			1967	β^+=75.4 9;α=24.6 9	
^{205}Rn^m	−7053	5	657.1	0.5	> 10 s		$13/2^+$#	20			2010	IT≈100;α ?;β^+ ?	
^{205}Fr	−1310	8			3.90 s	0.07	$9/2^-$*	20			1964	α=98.5 4;β^+=1.5 4	*
^{205}Fr^m	−766	8	544.0	1.0	80 ns	20	$13/2^+$	20			2012	IT=100	
^{205}Fr^n	−701	10	609	6	1.15 ms	0.04	$(1/2^+)$	20			2012	IT=100	
^{205}Ra	5804	23			220 ms	50	$3/2^-$	20	96Le09	T	1987	α≈100;β^+ ?	*
^{205}Ra^m	6067	11	263	25	180 ms	50	$13/2^+$	20	17Al34	E	1995	α≈100;IT ?;β^+ ?	*
^{205}Ac	14110	60			80 ms	60	$9/2^-$	20	14Zh03	T	2014	α≈100;β^+ ?	*

*^{205}Hg T : other 10Ku02=5.61(0.38) for q=80+ (bare ion) **
*^{205}Tl J : other 13Ba41,12Ba32=1/2 **
*^{205}At J : 18Cu02=9/2 **
*^{205}Fr J : 14Ly01,13Vo10,15Vo05,13Fl09=9/2 **
*^{205}Ra T : symmetrized from 96Le09=210(+60-40) **
*^{205}Ra J : favored α decay to ^{201}Rn (J=3/2-) **
*^{205}Ra^m T : symmetrized from 96Le09=170(+60-40); other 10He25=68(+68-23) **
*^{205}Ra^m J : favored α decay to ^{201}Rn^m (J=13/2+) **
*^{205}Ac T : symmetrized from 14Zh03=20(+97-9) **
*^{205}Ac J : favored α decay to ^{201}Fr (J=9/2-) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life		J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{206}Pt	−9240#	300#			500# ms	>300ns	0^+	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{206}Au	−14190#	300#			47 s	11	6^+#	16	17Ca12	TJ	2009	β^-=100	*
^{206}Hg	−20946	20			8.32 m	0.07	0^+	08			1961	β^-=100	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$^{206}\mathrm{Hg}^m$	−18844	20	2102.4	0.3		2.088	μs	0.017	5^-	08	11St21	T	1982	IT=100	∗
$^{206}\mathrm{Hg}^n$	−17224	20	3722.3	1.0		106	ns	3	(10^+)	08	18La03	T	2001	IT=100	∗
$^{206}\mathrm{Tl}$	−22253.3	1.3				4.202	m	0.011	0^-∗	08			1935	β^-=100	
$^{206}\mathrm{Tl}^m$	−19610.2	1.3	2643.10	0.18		3.74	m	0.03	$(12)^-$	08			1976	IT=100	∗
$^{206}\mathrm{Pb}$	−23785.5	1.1				STABLE		>2.5Zy	0^+	08	13Be16	T	1927	IS=24.1 30;α ?	
$^{206}\mathrm{Pb}^m$	−21585.3	1.1	2200.16	0.04		125	μs	2	7^-	08			1953	IT=100	
$^{206}\mathrm{Pb}^n$	−19758.2	1.3	4027.3	0.7		202	ns	3	12^+	08			1971	IT=100	∗
$^{206}\mathrm{Bi}$	−20028	8				6.243	d	0.003	6^+∗	08			1947	β^+=100	
$^{206}\mathrm{Bi}^m$	−19968	8	59.897	0.017		7.7	μs	0.2	4^+	08			1957	IT=100	
$^{206}\mathrm{Bi}^n$	−18983	8	1044.8	0.7		890	μs	10	10^-	08			1974	IT=100	
$^{206}\mathrm{Bi}^p$	−10795	8	9233.3	0.8		155	ns	15	(28^-)		12Ci05	EJD	2012	IT=100	
$^{206}\mathrm{Bi}^q$	−9858	8	10170.5	0.8		> 2	μs		(31^+)		12Ci05	EJD	2012	IT=100	
$^{206}\mathrm{Po}$	−18189	4				8.8	d	0.1	0^+	08			1947	β^+=94.55 5;α=5.45 5	
$^{206}\mathrm{Po}^m$	−16603	4	1585.90	0.11		232	ns	4	8^+	08			1970	IT=100	
$^{206}\mathrm{Po}^n$	−15927	4	2262.09	0.12		1.05	μs	0.06	9^-	08	FGK145	J	1970	IT=100	
$^{206}\mathrm{At}$	−12439	14				30.6	m	0.8	$(6)^+$∗	08			1961	β^+=99.10 8;α=0.90 8	∗
$^{206}\mathrm{At}^m$	−11629	14	810	2		813	ns	21	$(10)^-$	08	09Dr08	T	1999	IT=100	∗
$^{206}\mathrm{Rn}$	−9133	9				5.67	m	0.17	0^+	08			1954	α=62 3;β^+=38 3	
$^{206}\mathrm{Fr}$	−1247	28				∼ 16	s		3^+∗	08	16Ly01	D	1964	α=88.4 33;β^+=11.6 33	∗
$^{206}\mathrm{Fr}^m$	−1048	28	200	40	IT	∼ 16	s		7^+∗	08	16Ly01	D	1964	α=84.7 15;β^+ ?;IT ?	∗
$^{206}\mathrm{Fr}^n$	−517	28	730	40		700	ms	100	10^-∗	08	16Ly01	D	1983	IT=?;α=13 2	∗
$^{206}\mathrm{Fr}^x$	−1150	100	100	100	MD	R =?			*spmix*						
$^{206}\mathrm{Ra}$	3566	18				240	ms	20	0^+	08			1967	α≈100;β^+ ?	
$^{206}\mathrm{Ac}$	13480	70				25	ms	7	3^+	08			1998	α≈100;β^+ ?	∗
$^{206}\mathrm{Ac}^m$	13690	30	200	70	AD	41	ms	16	10^-	08			1996	α≈100;β^+ ?	∗

∗^{206}Au T : average 17Ca12=56(17) 15Mo20=40(15) ∗∗
∗^{206}Hg^m T : average 11St21(=09Si35)=2.09(0.02) 82Be38=2.15(0.21) 18La03=2.08(0.04) ∗∗
∗^{206}Hg^n T : averageg 11St21(=09Si35)=112(4) 09Al29=96(15) 01Fo08=92(8) 01La09=90(10) ∗∗
∗^{206}Hg^n T : 18La03=106(15) ∗∗
∗^{206}Tl^m J : from l(d,α)=11 in 77Fr11 ∗∗
∗^{206}Pb^n T: other 18La03=203(28), outweighed not used ∗∗
∗^{206}At J : 18Cu02=(6) ∗∗
∗^{206}At^m T : others 10Ka29=377(44) 99Fe10=410(80) ∗∗
∗^{206}At^m E : 806.7(1.4) + x keV; x<6 keV estimated by Nubase ∗∗
∗^{206}Fr J : 14Ly01,13Vo10,15Vo05=3 ∗∗
∗^{206}Fr^m J : 15Vo05=7,14Ly01=(7) ∗∗
∗^{206}Fr^n E : 531(2) keV above ^{206}Fr^m in 81Ri04 ∗∗
∗^{206}Fr^n J : 15Vo05=10,14Ly01=(7) ∗∗
∗^{206}Fr^n D : IT reported in 81Ri04 ∗∗
∗^{206}Ac T : symmetrized from 98Es02=22(+9-5); other 14Zh03=41(+56-15) ∗∗
∗^{206}Ac J : favored α decay to ^{202}At (J=3+) ∗∗
∗^{206}Ac^m T : symmetrized from 98Es02=33(+22-9) ∗∗
∗^{206}Ac^m J : favored α decay to ^{202}At^m (J=10-) ∗∗

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$^{207}\mathrm{Pt}$	−4140#	400#				600#	ms	>300ns	$9/2^+$#	13	12Ku26	I	2012	β^- ?;β^-n ?	
$^{207}\mathrm{Au}$	−10640#	300#				3#	s	>300ns	$3/2^+$#	11			2010	β^- ?;β^-n ?	
$^{207}\mathrm{Hg}$	−16487	30				2.9	m	0.2	$9/2^+$	11	20Ta03	J	1982	β^-=100	
$^{207}\mathrm{Tl}$	−21034	5				4.77	m	0.02	$1/2^+$∗	11	13Ba41	J	1908	β^-=100	∗
$^{207}\mathrm{Tl}^m$	−19686	5	1348.18	0.16		1.33	s	0.11	$11/2^-$	11			1965	IT≈100;β^- ?	
$^{207}\mathrm{Pb}$	−22452.0	1.1				STABLE		>1.9Zy	$1/2^-$∗	11	13Be16	T	1927	IS=22.1 50;α ?	
$^{207}\mathrm{Pb}^m$	−20818.6	1.1	1633.356	0.004		806	ms	5	$13/2^+$	11			1951	IT=100	
$^{207}\mathrm{Bi}$	−20054.6	2.4				31.22	y	0.17	$9/2^-$	11	14Un01	T	1950	β^+=100	
$^{207}\mathrm{Bi}^m$	−17953.0	2.4	2101.61	0.16		182	μs	6	$21/2^+$	11			1967	IT=100	
$^{207}\mathrm{Po}$	−17146	7				5.80	h	0.02	$5/2^-$∗	11			1947	β^+≈100;α=0.021 2	∗
$^{207}\mathrm{Po}^m$	−17077	7	68.557	0.014		205	ns	10	$1/2^-$	11			1963	IT=100	
$^{207}\mathrm{Po}^n$	−16031	7	1115.076	0.017		49	μs	4	$13/2^+$	11			1962	IT=100	
$^{207}\mathrm{Po}^p$	−15763	7	1383.16	0.07		2.79	s	0.08	$19/2^-$	11			1961	IT=100	
$^{207}\mathrm{At}$	−13227	12				1.81	h	0.03	$9/2^-$∗	11			1951	β^+≈90;α≈10	∗
$^{207}\mathrm{At}^m$	−11110	12	2117.3	0.6		108	ns	2	$25/2^+$	11			1981	IT=100	
$^{207}\mathrm{Rn}$	−8635	5				9.25	m	0.17	$5/2^-$∗	11			1954	β^+=79 3;α=21 3	
$^{207}\mathrm{Rn}^m$	−7736	5	899.1	1.0		184.5	μs	0.9	$13/2^+$	11			1974	IT=100	
$^{207}\mathrm{Fr}$	−2849	18				14.8	s	0.1	$9/2^-$∗	11			1964	α=95 2;β^+ ?	∗

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{207}Ra	3510	60				1.38	s	0.18	$5/2^-$#	11			1967	$\alpha\approx86;\beta^+$?	*
^{207}Ra^m	4071	10	560	60	AD	57	ms	8	$13/2^+$	11	96Le09	T	1987	IT=85#;α=?;β^+ ?	*
^{207}Ac	11150	60				31	ms	8	$9/2^-$	11	98Es02	T	1994	$\alpha\approx100$	*
*^{207}Tl	T : others 05Oh08=4.25(0.14) 10Ku02=4.70(0.19) for q=81+ (bare ion)														**
*^{207}Po	J : other 15Fi07=5/2														**
*^{207}At	J : 18Cu02=9/2														**
*^{207}Fr	J : other 17Wi11,14Ly01=9/2														**
*^{207}Ra	T : average 95Uu01=1.1(+0.9-0.3) 68Lo15=1.8(0.5) 67Va22=1.3(0.2)														**
*^{207}Ra^m	T : average 96Le09=63(16) 87He10=55(10)														**
*^{207}Ra^m	J : favored α decay to ^{203}Rn^m (J=13/2+)														**
*^{207}Ac	T : average 98Es02=27(+11-6) 94Le05=22(+40-9)														**
*^{207}Ac	J : favored α decay to ^{203}Fr (J=9/2-)														**
^{208}Pt	−500#	400#				220#	ms	>300ns	0^+	13	12Ku26	I	2012	β^- ?;β^-n ?	
^{208}Au	−5910#	300#				20#	s	>300ns	6^+#	11	10Al24	I	2010	β^- ?;β^-n ?	
^{208}Hg	−13270	30				135	s	10	0^+	10	20Ca25	T	1994	β^-=100	*
^{208}Hg^m	−11930	40	1338	24		99	ns	14	(8^+)	10			2009	IT=100	*
^{208}Tl	−16750.1	1.9				3.053	m	0.004	5^+	07			1909	β^-=100	
^{208}Tl^m	−14943.1	2.1	1807	1		1.3	μs	0.1	(0^-)		20Ca25	TEJ	2020	IT-=100	
^{208}Pb	−21748.5	1.1				STABLE		>2.6Zy	0^+	07	13Be16	T	1927	IS=52.4 70;α ?	
^{208}Pb^m	−16853.3	1.1	4895.23	0.05		535	ns	35	10^+	07	17Br08	T	1998	IT=100	*
^{208}Bi	−18870.2	2.3				368	ky	4	5^+*	07	18Sc05	J	1953	β^+=100	
^{208}Bi^m	−17299.1	2.3	1571.1	0.4		2.58	ms	0.04	10^-	07			1961	IT=100	
^{208}Po	−17469.2	1.7				2.898	y	0.002	0^+	07	93Sa14	D	1947	$\alpha\approx100;\beta^+$=0.0042 4	
^{208}Po^m	−15941.0	1.7	1528.22	0.04		373	ns	8	8^+	07	20Br.A	T	1968	IT=100	*
^{208}At	−12470	9				1.63	h	0.03	6^+*	07			1950	β^+=99.45 6;α=0.55 6	*
^{208}At^m	−10194	9	2276.4	1.8		1.5	μs	0.2	16^-	07			1991	IT=100	
^{208}Rn	−9655	10				24.35	m	0.14	0^+	07			1955	α=62 7;β^+=38 7	
^{208}Rn^m	−7827	10	1828.3	0.4		487	ns	12	8^+	07			1979	IT=100	*
^{208}Fr	−2665	12				59.1	s	0.3	7^+*	07			1964	α=89 3;β^+=11 3	*
^{208}Fr^m	−1839	12	826.3	0.5		432	ns	11	10^-	07	09Dr08	TJE	2009	IT=100	*
^{208}Ra	1728	9				1.110	s	0.045	0^+	07	10He25	TD	1967	α=87 3;β^+ ?	*
^{208}Ra^m	3875	9	2147.4	0.4		263	ns	17	(8^+)	07	05Re02	T	1998	IT=100	*
^{208}Ac	10760	60				97	ms	15	3^+	07	14Ya19	T	1994	$\alpha\approx100;\beta^+$?	*
^{208}Ac^m	11258	28	500	60	AD	28	ms	7	10^-	07	96Ik01	T	1994	$\alpha\approx100$;IT ?;β^+ ?	*
^{208}Th	16690	30				2.4	ms	1.2	0^+	11			2010	$\alpha\approx100$	*
*^{208}Hg	T : average 20Ca25=135(10) 17Ca12=132(50); others (conflicting)														**
*^{208}Hg	T : 98Zh22=2460(+300-200) 94Zh02=2520(+1380-720)														**
*^{208}Hg^m	E : 1296.9(0.9) + x keV; x<83 keV														**
*^{208}Pb^m	T : average 17Br08=570(50) 89Ro04=500(50)														**
*^{208}Po^m	T : average 20Br.A=377(9) 76Ha56=350(20)														**
*^{208}At	J : 18Cu02=6														**
*^{208}Rn^m	T : other 10Ka29=590(144)														**
*^{208}Fr	J : other 13Vo10,15Vo05=7														**
*^{208}Fr^m	T : from 09Dr08, τ=623(16); others 10Ka29=233(18), not trusted														**
*^{208}Fr^m	T : 06Me03=446(14), originally assigned to ^{209}Fr, see 09Dr04														**
*^{208}Ra	T : others 68Lo15=1.8(0.5) 67Va22=1.2(0.2)														**
*^{208}Ra^m	T : average 05Re02=250(30) 99Co13=270(21)														**
*^{208}Ac	T : average 14Ya19=93(+40-22) 96Ik01=83(+34-19) 94Le05=95(+24-16)														**
*^{208}Ac	J : favored α decay to ^{204}Fr (J=3+)														**
*^{208}Ac^m	T : average 96Ik01=21(+28-8) 94Le05=25(+9-5)														**
*^{208}Ac^m	J : favored α decay to ^{204}Fr^n (J=10-)														**
*^{208}Th	T : symmetrized from 10He25=1.7(+1.7-0.6)														**
^{209}Au	−2230#	400#				1#	s	>300ns	$3/2^+$#	15	10Al24	I	2010	β^- ?;β^-n ?	
^{209}Hg	−8610#	150#				6.3	s	1.1	$9/2^+$#	15	17Ca12	T	1998	β^-=100;β^-n ?	*
^{209}Tl	−13645	6				2.162	m	0.007	$1/2^+$	15			1950	β^-=100;β^-n ?	
^{209}Tl^m	−12417	6	1228.1	2.0		146	ns	10	$17/2^+$	15	17Am01	ETJ	2009	IT=100	*
^{209}Pb	−17614.6	1.7				3.235	h	0.005	$9/2^+$	15	21Ta01	T	1940	β^-=100	*
^{209}Bi	−18258.6	1.4				20.1	Ey	0.8	$9/2^-$*	15			1924	IS=100;α=100	*
^{209}Po	−16366.0	1.8				124	y	3	$1/2^-$*	15			1949	α=99.546 7;β^+=0.454 7	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{209}Po^m	−12100.6	1.8	4265.4	0.3		119	ns	4	$31/2^-$	15			1974	IT=100	
^{209}At	−12884	5				5.42	h	0.05	$9/2^-$*	15	17Lo13	D	1951	β^+=96.1 4;α=3.9 4	*
^{209}At^m	−10455	5	2429.32	0.22		916	ns	10	$29/2^+$	15			1975	IT=100	
^{209}Rn	−8941	10				28.8	m	1.0	$5/2^-$*	15	87Bo29	J	1952	β^+=83 2;α=17 2	*
^{209}Rn^m	−7767	10	1174.01	0.13		13.4	μs	1.3	$13/2^+$	15			1985	IT=100	
^{209}Rn^n	−5304	10	3636.81	0.23		3.0	μs	0.3	$35/2^+$	15			1985	IT=100	
^{209}Fr	−3782	12				50.5	s	0.7	$9/2^-$*	15			1964	α=89 3;β^+=11 3	
^{209}Fr^m	878	12	4659.8	0.7		420	ns	18	$45/2^-$	15			2006	IT=100	*
^{209}Ra	1858	6				4.71	s	0.08	$5/2^-$*	15	08Ha12	T	1967	$\alpha\approx$100;β^+ ?	
^{209}Ra^m	2740	6	882.4	0.7		117	μs	5	$13/2^+$	15	08Ha12	D	2008	$\alpha\approx$90;$\beta^+\approx$10	
^{209}Ac	8840	60				94	ms	10	$9/2^-$	15	14Ya19	T	1968	$\alpha\approx$100;β^+ ?	*
^{209}Th	16400#	100#				60#	ms		$5/2^-$#					α ?;β^+ ?	
^{209}Th^m	16765	25	370#	100#		3.1	ms	1.2	$13/2^+$	15	10He25	T	1996	$\alpha\approx$100;β^+ ?	*

*^{209}Hg T : others 98Zh19=35(+9-6) 98Zh22=35(+13-8),42(+24-11) and 36(+16-8) **
*^{209}Tl^m T : other 09Al29=95(11) **
*^{209}Pb T : average 21Ta01=3.252(0.043) 13Su13=3.232(0.005) 72Be44=3.253(0.014); **
*^{209}Pb T : others 40Kr08=2.75(0.05) 42Ma03=3.3(1.9) 41Fa04=3.32(0.03) **
*^{209}Pb T : 59Po64=3.31(0.03) 71Pe03=3.31(0.03) **
*^{209}Bi J : others 17Ba12,18Sc05=9/2 **
*^{209}Po J : other 13Se03,14Se07=1/2 **
*^{209}At D : %α average 17Lo13=3.6(0.7) 68Gu.A=4.1(0.5) **
*^{209}At J : 18Cu02=9/2 **
*^{209}Rn D : other 17Lo13 %β^+=91(2) %α=9(2), likely due to Rn diffusion **
*^{209}Fr^m T : from 09Dr04, τ=606(26); **
*^{209}Ac T : average 14Ya19=98(22) 00He17=98(+59-27) 96Ik01=82(+18-13) **
*^{209}Ac T : 94Le05=91(+21-14) 68Va04=100(50) **
*^{209}Ac J : favored α decay to ^{205}Fm (J=9/2-) **
*^{209}Th^m T : symmetrized from 10He25=2.5(+1.7-0.7), based on 4 events from 10He25 **
*^{209}Th^m T : combined with 2 events from 96Ik01 **
*^{209}Th^m J : favored α decay to ^{205}Ra^m (J=13/2+) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{210}Au	2680#	400#				10#	s	>300ns	6^+#	14	10Al24	I	2010	β^- ?;β^-n ?	
^{210}Hg	−5300#	200#				64	s	12	0^+	14	17Ca12	TD	1998	β^-=100;β^-n=2.2 22	
^{210}Hg^m	−4640#	200#	663	2		2.1	μs	0.7	(3^-)	14			2013	IT=100	
^{210}Hg^n	−3890#	200#	1406	23		2	μs	1	8^+#	14	13Go10	E	2013	IT=100	*
^{210}Tl	−9247	12				1.30	m	0.03	5^+#	14			1909	β^-=100;β^-n=0.009 6	*
^{210}Tl^m	−8050#	200#	1200#	200#		1#	m	>3 us	$9^+,10^+$		18Br15	ID	2018	β^- ?; IT ?	*
^{210}Pb	−14728.4	1.4				22.20	y	0.22	0^+	14			1900	β^-=100;α=1.9e-6 4	
^{210}Pb^m	−13533.8	1.4	1194.61	0.18		92	ns	10	6^+		18Br15	ETJ	2018	IT=100	
^{210}Pb^n	−13453.6	1.4	1274.8	0.3		201	ns	17	8^+	14			1980	IT=100	
^{210}Bi	−14791.9	1.4				5.012	d	0.005	1^-*	14			1905	β^-=100;α=13.2e-5 10	
^{210}Bi^m	−14520.6	1.4	271.31	0.11		3.04	My	0.06	9^-	14			1953	α=100	
^{210}Po	−15953.1	1.1				138.376	d	0.002	0^+	14			1898	α=100	
^{210}Po^m	−14396.1	1.1	1556.97	0.03		98.9	ns	2.5	8^+	14			1968	IT=100	
^{210}Po^n	−10895.5	1.1	5057.65	0.05		263	ns	5	16^+	14			1985	IT=100	
^{210}At	−11972	8				8.1	h	0.4	$(5)^+$*	14			1949	β^+=99.825 20;α=0.175 20	*
^{210}At^m	−9422	8	2549.6	0.2		482	ns	6	$(15)^-$	14			1970	IT=100	
^{210}At^n	−7944	8	4027.7	0.2		5.66	μs	0.07	$(19)^+$	14			1975	IT=100	
^{210}Rn	−9605	5				2.4	h	0.1	0^+	14			1952	α=96 1;β^+ ?	
^{210}Rn^m	−7900	30	1710	30	AD	644	ns	40	8^+	14	05Po10	JT	1979	IT=100	
^{210}Rn^n	−5750	30	3857	30		1.06	μs	0.05	17^-	14	05Po10	JT	1979	IT=100	*
^{210}Rn^p	−3090	30	6514	30		1.04	μs	0.07	23^+	14	05Po10	JT	1986	IT=100	*
^{210}Fr	−3344	13				3.18	m	0.06	6^+*	14	05Ku06	D	1964	α=71 4;β^+ ?	
^{210}Fr^m	1073	13	4417.2	1.0		475	ns	6	$(23)^+$		16Ma41	ETJ	2016	IT=100	*
^{210}Ra	443	9				4.0	s	0.1	0^+	14	08Ha12	T	1967	$\alpha\approx$100;β^+ ?	*
^{210}Ra^m	2494	9	2050.9	0.7		2.29	μs	0.03	8^+	14	04Re04	TJ	1998	IT=100	*
^{210}Ac	8760	60				350	ms	40	7^+#	14	00He17	T	1968	$\alpha\approx$100;β^+ ?	*
^{210}Th	14060	19				16.0	ms	3.6	0^+	14			1995	$\alpha\approx$100;β^+ ?	

*^{210}Hg^n E : 1366 + x keV; x<80 from 13Go10 **
*^{210}Tl D : %β^-n symmetrized from 61St20=0.007(+7-4)% **
*^{210}Tl^m DIJ : direct β^- to 10+ in ^{210}Pb in 18Br15; conf=ph11/2 ng9/2 **
*^{210}At J : 18Cu02=(5) **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{210}Rn^n E : 2147.4(0.2) keV above the 8+ level at 1664.6(0.1) **
*^{210}Rn^p E : 4803.7(0.4) keV above the 8+ level at 1664.6(0.1) **
*^{210}Fr^m E : uncertainty estimated by evaluator **
*^{210}Ra T : others 07Le14=2.5(+1.4-0.7) and 3.5(+4.8-1.3) 68Lo15=3.6(0.2) **
*^{210}Ra T : 67Va22=3.8(0.2) **
*^{210}Ra^m T : average 13Ba29=2.1(0.1) 06Ha17=2.28(0.08) 04Re04=2.1(0.1) **
*^{210}Ra^m T : 04He25=2.36(0.04); other 99Co13=2.24 **
*^{210}Ac T : average 00He17=335(+64-46) 68Va04=350(50) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{211}Hg	−390#	200#				26.4	s	8.1	$9/2^+$#	13	17Ca12	TD	2010	β^-=100;β^-n=6.3 63	
^{211}Tl	−6080	40				81	s	16	$1/2^+$	13	14Mo02	TJ	1998	β^-=100;β^-n=2.2 22	*
^{211}Tl^m	−4840#	110#	1244#	100#		580	ns	80	$17/2^+$#		19Go10	ETJ	2019	IT=100	*
^{211}Pb	−10493.0	2.3				36.1628	m	0.0025	$9/2^+$*	13	17Lo.1	T	1904	β^-=100	*
^{211}Pb^m	−8774	23	1719	23		159	ns	28	$(27/2^+)$	13	05La01	JT	2005	IT=100	*
^{211}Bi	−11859	5				2.14	m	0.02	$9/2^-$*	13	18Ba03	J	1905	$\alpha\approx$100;β^-=0.276 4	
^{211}Bi^m	−10602	11	1257	10		1.4	μs	0.3	$(25/2^-)$	13			1998	IT=100	
^{211}Po	−12432.5	1.3				516	ms	3	$9/2^+$*	15			1913	α=100	*
^{211}Po^m	−10970	5	1462	5	AD	25.2	s	0.6	$(25/2^+)$	15			1954	α=99.984 4;IT=0.016 4	
^{211}Po^n	−10298	5	2135	5		243	ns	21	$(31/2^-)$	15			1998	IT$\approx$100;α ?	
^{211}Po^p	−7561	6	4872	6		2.8	μs	0.7	$(43/2^+)$	15			1998	IT$\approx$100;α ?	
^{211}At	−11647.2	2.7				7.214	h	0.007	$9/2^-$*	13			1940	ε=58.20 8;α=41.80 8	*
^{211}At^m	−6832.7	2.7	4814.5	0.5		4.23	μs	0.07	$(39/2^-)$	13			1971	IT=100	
^{211}Rn	−8755	7				14.6	h	0.2	$1/2^-$*	13			1952	β^+=72.6 17;α=27.4 17	*
^{211}Rn^m	−7152#	16#	1603#	14#		596	ns	28	$17/2^-$	13	81Po08	EJT	1981	IT=100	*
^{211}Rn^n	150#	21#	8905#	20#		201	ns	4	$63/2^-$	13	85Po06	EJT	1981	IT=100	*
^{211}Fr	−4140	12				3.10	m	0.02	$9/2^-$*	13	05Ku06	D	1964	α=87 3;β^+=13 3	*
^{211}Fr^m	−1717	12	2423.16	0.24		146	ns	14	$29/2^+$	13	86By01	ETJ	1986	IT=100	
^{211}Fr^n	517	12	4657.3	0.4		124.5	ns	1.2	$45/2^-$	13	16Ma41	T	1986	IT=100	*
^{211}Ra	832	5				12.6	s	1.2	$5/2^-$*	13	19Zh54	T	1967	$\alpha\approx$100;β^+ ?	*
^{211}Ra^m	2030	5	1198.1	0.8		9.5	μs	0.3	$13/2^+$	13	13Ba29	T	2004	IT=100	*
^{211}Ac	7140	50				213	ms	25	$9/2^-$	13	00He17	T	1968	$\alpha\approx$100;β^+ ?	*
^{211}Th	13880	90				48	ms	20	$5/2^-$#	13			1995	$\alpha\approx$100;β^+ ?	*
^{211}Pa	22050	70				6	ms	3	$9/2^-$	13	20Au04	TD	2006	$\alpha\approx$100;β^+ ?;p ?	*

*^{211}Tl T : average 17Ca12=77(18) 14Mo02,12Be28=88(+46-29) **
*^{211}Tl^m E : 144 keV + x keV; x=1100#(100#) keV by Nubase from interpretation in **
*^{211}Tl^m E : 19Go10 and similarity with ^{209}Tl^m **
*^{211}Pb T : others 16Ai01=36.164(0.013) 15Ko09=36.165(0.037) **
*^{211}Pb^m E : 1679.1 + x keV; x<80 keV estimated by Nubase **
*^{211}Po J : 13Se03,14Se07,15Fi07=9/2 **
*^{211}At J : 18Cu02=9/2 **
*^{211}Rn J : other 83Ah03=5/2 (same group) **
*^{211}Rn^m E : 1577.8 + x keV; x<50 keV from 81Po08 **
*^{211}Rn^n E : from 8880#(14#) + y keV; y<50 keV from 85Po06 **
*^{211}Fr J : other 14Ly01=9/2 **
*^{211}Fr^n J : from 86By01 **
*^{211}Ra T : average 19Zh54=10(3) 07Le14=9(5) 68Lo15=12(2) 67Va22=15(2) **
*^{211}Ra D : %α estimated by Nubase **
*^{211}Ra^m T : average 13Ba29=9.4(0.4) 06Ha17=9.7(0.6); other 04He25=4.0(0.5) **
*^{211}Ac T : average 00He17=200(29) 68Va04=250(50) **
*^{211}Th T : symmetrized from 95Uu01=37(+28-11); other 15Ya13=20.8(+37.9-8.2) (2 evts) **
*^{211}Pa T : symmetrized from 20Au04=3.8(+4.6-1.4) **
*^{211}Pa J : favored α decay to ^{207}Ac (J=9/2-) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{212}Hg	3020#	300#				30#	s	>300ns	0^+	20	10Al24	I	2010	β^- ?;β^-n ?	
^{212}Tl	−1550#	200#				31	s	8	(5^+)	20	17Ca12	TD	1998	β^-=100;β^-n=1.8 18	*
^{212}Pb	−7548.9	1.8				10.627	h	0.006	0^+	20	17Ko16	T	1905	β^-=100	*
^{212}Pb^m	−6213.9	2.7	1335	2		6.0	μs	0.8	8^+#	20	12Re.B	E	1998	IT=100	*
^{212}Bi	−8117.9	1.9				60.55	m	0.06	1^-*	20	89Ha.A	D	1905	β^-=64.06 6;α=35.94 6; $\beta^-\alpha\approx$0.014	*
^{212}Bi^m	−7870	30	250	30	MD	25.0	m	0.2	$(8^-,9^-)$	20			1978	α=67 1;β^-=33 1;$\beta^-\alpha$=30 1	
^{212}Bi^n	−6639	30	1479	30	MD	7.0	m	0.3	(18^-)	20	13Ch12	D	1978	β^-=?;IT ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{212}Po	−10369.4	1.2				294.4 ns 0.8	0^+	20	17Ap03	T	1906	α=100	*
^{212}Po^m	−7446	5	2923	4	AD	45.1 s 0.6	(18^+)	20			1962	α=99.93 2;IT ?	
^{212}At	−8628.1	2.4				314 ms 3	(1^-)	20			1954	α≈100;β$^+$?;β$^-$?	
^{212}At^m	−8405.2	2.4	222.9	0.9	AD	119 ms 3	(9^-)	20			1970	α≈100;IT ?	
^{212}At^n	−3856.7	2.8	4771.4	1.5		152 μs 5	(25^-)	20			1998	IT=100	
^{212}Rn	−8659	3				23.9 m 1.2	0^+	20			1950	α=100	
^{212}Rn^m	−7019	3	1639.68	0.15		118 ns 14	6^+	20			1971	IT=100	
^{212}Rn^n	−6965	3	1694.1	0.3		910 ns 30	8^+	20			1971	IT=100	
^{212}Rn^p	−2485	3	6174.2	0.3		102 ns 4	22^+	20	09Dr12	J	1977	IT=100	
^{212}Rn^q	−80	3	8579.2	0.4		154 ns 14	30^+	20	09Dr12	J	1977	IT=100	
^{212}Fr	−3516	9				20.0 m 0.6	5^+*	20			1950	β$^+$=57 2;α=43 2	
^{212}Fr^m	−1965	9	1551.4	0.3		31.9 μs 0.7	11^+	20	86By01	J	1977	IT=100	
^{212}Fr^n	−1024	9	2492.2	0.4		604 ns 28	15^-	20	86By01	J	1977	IT=100	
^{212}Fr^p	2339	9	5854.7	0.6		312 ns 21	27^-	20	86By01	J	1986	IT=100	
^{212}Fr^q	5017	9	8533.4	1.1		23.6 μs 2.1	34^+#	20			1990	IT=100	
^{212}Ra	−199	10				13.0 s 0.2	0^+	20			1967	α=?;β$^+$?	
^{212}Ra^m	1759	10	1958.4	2.0		9.3 μs 0.9	8^+	20			1986	IT=100	
^{212}Ra^n	2414	10	2613.3	2.0		850 ns 130	11^-	20	13Ba29	T	1986	IT=100	
^{212}Ac	7300	22				895 ms 28	7^+*	20	14Ya19	T	1968	α≈100;β$^+$?	*
^{212}Th	12111	10				31.7 ms 1.3	0^+	20			1980	α≈100;β$^+$?	
^{212}Pa	21600	90				5.8 ms 1.9	3^+#	20	20Au04	T	1997	α=100	*

*^{212}Tl T : other 14Mo02,12Be28=96(+42-38) **
*^{212}Pb T : average 17Ko06=10.622(0.007) 55To11=10.643 (0.012) **
*^{212}Pb^m T : 12Go19=6.0(0.8) supersedes 12Re.B=5.0(0.3); other 98Pf02=5(1) **
*^{212}Bi J : 17Ba12=1 **
*^{212}Po T : average 17Ap03=293.9(1.0,stat)(0.6,syst) 13Be31=294.7(0.8,stat)(0.6syst) **
*^{212}Ac T : average 14Ya19=880(35) 00He17=880(110) 68Va04=930(50); **
*^{212}Ac T : other 19Zh23=1.6(+0.9-0.4) **
*^{212}Ac J : 17Gr18,16Fe11=(7); favored α decay to ^{208}Fr (J=7+) **
*^{212}Pa T : average 20Au04=4.5(+2.7,-1.3) 14Ya10=5.1(+5.1-1.7), combining **
*^{212}Pa T : 14Ya10 and 97Mi03 **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{213}Hg	8200#	300#				15# s >300ns	$9/2^+$#	11	10Al24	I	2010	β$^-$?;β$^-$n ?	
^{213}Tl	1784	27				23.8 s 4.4	$1/2^+$#	12	17Ca12	TD	2010	β$^-$=100;β$^-$n=7.6 34	*
^{213}Tl^m	2460#	300#	680#	300#		4.1 μs 0.5			19Go10	TDE	2019	IT=100	*
^{213}Tl^n	3030#	100#	1250#	100#		0.6 μs 0.3	$17/2^+$#		19Go10	TDE	2019	IT=100	*
^{213}Pb	−3204	7				10.2 m 0.3	$(9/2^+)$	07			1964	β$^-$=100	
^{213}Pb^m	−1873	7	1331.0	1.7		260 ns 20	$(21/2^+)$		20Do.A	JTD	2020	IT=100	
^{213}Bi	−5232	5				45.60 m 0.04	$9/2^-*$	07	18Ba03	J	1947	β$^-$=97.91 3;α=2.09 3	*
^{213}Bi^m	−3879	22	1353	21		> 168 s	$25/2^-$#		08Ch.A	T	2008	β$^-$?; IT ?	*
^{213}Po	−6654	3				3.705 μs 0.001	$9/2^+$	07	20Ko06	T	1947	α=100	*
^{213}At	−6580	5				125 ns 6	$9/2^-$	07			1968	α=100	
^{213}At^m	−5222	24	1358	23		110 ns 17	$25/2^-$#	07			1980	IT=100	*
^{213}At^n	−3582	27	2998	27		45 μs 4	$49/2^+$#	07	03LaZZ	TEJ	2003	IT=100	*
^{213}Rn	−5696	3				19.5 ms 0.1	$9/2^+$#	07			1967	α=100	*
^{213}Rn^m	−4014	10	1682	10		1.00 μs 0.21	$(25/2^+)$	07			1988	IT=100	*
^{213}Rn^n	−3491	10	2205	10		1.36 μs 0.07	$(31/2^-)$	07			1988	IT=100	*
^{213}Rn^p	269	14	5965	14		164 ns 11	$(55/2^+)$	07			1988	IT=100	*
^{213}Fr	−3554	5				34.14 s 0.06	$9/2^-*$	07	13Fi08	T	1964	α=99.44 5;β$^+$=0.56 5	*
^{213}Fr^m	−1964	5	1590.41	0.18		505 ns 14	$21/2^-$	07			1971	IT=100	
^{213}Fr^n	−1016	5	2537.62	0.23		238 ns 6	$29/2^+$	07			1971	IT=100	
^{213}Fr^p	4541	5	8094.8	0.7		3.1 μs 0.2	$(65/2^-)$	07			1989	IT=100	
^{213}Ra	346	10				2.73 m 0.05	$1/2^-*$	07	17Lo13	D	1955	α=87 2;β$^+$=13 2	
^{213}Ra^m	2114	11	1768	4	AD	2.20 ms 0.05	$(17/2^-)$	07	06Ku26	TD	1976	IT≈99;α=0.6 4	
^{213}Ac	6141	12				738 ms 16	$9/2^-*$	07			1968	α≈100;β$^+$?	*
^{213}Th	12120	9				144 ms 21	$5/2^-$	07			1968	α≈100;β$^+$?	*
^{213}Th^m	13300	9	1180.0	1.4		1.4 μs 0.4	$(13/2)^+$		07Kh22	TDJ	2007	IT=100	*
^{213}Th^p	12380#	50#	260#	50#									
^{213}Pa	19650	60				7.4 ms 2.4	$9/2^-$	07	20Au04	TD	1995	α=100	*

*^{213}Tl T : others 14Mo02,12Be28=46(+55-26) 10Ch19=101(+484-46) **
*^{213}Tl^m E : 380 keV + x; x=300#(300#) keV by Nubase **
*^{213}Tl^n E : 698 keV + x; x=550#(100#) keV by Nubase from interpretation in **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{213}Tl^{n}	E : 19Go10 and similarity with ^{209}Tl^{m}														**
*^{213}Bi	T : average 21Ta01=45.60(0.09) 13Ma13=45.62(0.06) 73Po16=45.59(0.06)														**
*^{213}Bi^{m}	E : from 12Ch19														**
*^{213}Po	T : average 20Ko06=3.709(12) 18Al32=3.705(1) 13Su13=3.708(8); other														**
*^{213}Po	T : 18Sa45=3.5(0.5)														**
*^{213}At^{m}	E : 1318.1(0.6) + x keV; 20<x<100 keV from 80Sj01														**
*^{213}At^{n}	E : 1615(2) + y keV above ^{213}At^{m}; y∼50 keV in 03LaZZ														**
*^{213}Rn	T : other 19Mi08=16(1)														**
*^{213}Rn	J : other 83Ah03=1/2, inconsistent with the excited structures														**
*^{213}Rn^{m}	E : 1664.0(1.0) + x keV; x<35 keV from 88St10														**
*^{213}Rn^{n}	E : 522.7 keV above ^{213}Rn^{m} from 88St10														**
*^{213}Rn^{p}	E : 4265 + y keV above ^{213}Rn^{m}; y<35 keV from 88St10														**
*^{213}Fr	T : others: 16Pr08=33.2(2.0) and 28.4(3.5) 19Mi08=20(+48-8)														**
*^{213}Fr	D : %β^+ other 17Lo13=0.25(0.15), discrepant likely due to Rn diffusion														**
*^{213}Ac	J : 17Gr18,16Fe11=(9/2); favored α decay to ^{209}Fr (J=9/2-)														**
*^{213}Th	J : favored α decay to ^{209}Ra (J=5/2-)														**
*^{213}Th^{m}	E : from 381(1) keV and 799(1) keV gammas in cascade; uncertainties														**
*^{213}Th^{m}	E : in gamma-ray energies were estimated by Nubase														**
*^{213}Pa	T : average 20Au04=4.9(+5.9-1.8) 95Ni05=5.3(+4.0-1.6)														**
*^{213}Pa	J : favored α decay to ^{209}Ac (J=9/2-)														**
^{214}Hg	11770#	400#				8#	s	>300ns	0^+	11	10Al24	I	2010	β^- ?;β^-n ?	
^{214}Tl	6470#	200#				11.0	s	2.4	5^+#	11	17Ca12	TD	2010	β^-=100;β^-n=34 12	
^{214}Pb	−183.0	2.0				27.06	m	0.07	0^+	15			1904	β^-=100	
^{214}Pb^{m}	1237	20	1420	20		6.2	μs	0.3	8^+#	15			2012	IT=100	*
^{214}Bi	−1201	11				19.9	m	0.4	1^-	09	89Ha.A	D	1904	β^-=99.979 1;α=0.021 1; $\beta^-\alpha\approx$0.003	
^{214}Bi^{m}	−660	30	539	30		> 93	s		8^-#		08Ch.A	TE	2008	β^+ ?; IT ?	
^{214}Po	−4470.0	1.4				163.47	μs	0.03	0^+	09	16Al28	T	1912	α=100	*
^{214}At	−3379	4				558	ns	10	1^-	09			1949	α=100	
^{214}At^{m}	−3321	8	59	9	AD	265	ns	30		09			1982	$\alpha\approx$100;IT ?	
^{214}At^{n}	−3147	5	232	5	AD	760	ns	15	9^-	09			1982	$\alpha\approx$100:IT ?	
^{214}Rn	−4320	9				259	ns	3	0^+	09	19Pa45	T	1970	α=100	*
^{214}Rn^{m}	275	9	4595.4	1.8		245	ns	30	(22^+)	09			1983	IT=100	
^{214}Fr	−958	9				5.51	ms	0.13	(1^-)*	09	19Mi06	T	1967	α=100	*
^{214}Fr^{m}	−837	8	121	5	AD	3.35	ms	0.05	(8^-)	09			1962	α=100	
^{214}Fr^{n}	−320	10	638	5		103	ns	4	(11^+)	09			1993	IT=100	*
^{214}Fr^{p}	5620#	100#	6577#	100#		108	ns	7	(33^+)	09			1994	IT=100	*
^{214}Ra	93	5				2.437	s	0.016	0^+	09	15Kh09	T	1967	α=99.941 4;β^+=0.059 4	*
^{214}Ra^{m}	1913	5	1819.7	1.8		118	ns	7	6^+	09			2004	IT=100	
^{214}Ra^{n}	1958	5	1865.2	1.8		67.3	μs	1.5	8^+	09			1971	IT=99.91 7;α=0.09 7	
^{214}Ra^{p}	2776	5	2683.2	1.8		295	ns	7	11^-	09			1979	IT=100	
^{214}Ra^{q}	3571	5	3478.4	1.8		279	ns	4	14^+	09			1979	IT=100	
^{214}Ra^{r}	4240	5	4146.8	1.8		225	ns	4	17^-	09			1979	IT=100	
^{214}Ra^{x}	6670	5	6577.0	1.8		128	ns	4	(25^-)	09			1992	IT=100	
^{214}Ac	6433	14				8.2	s	0.2	5^+*	09			1968	α=93 4;β^+=7 4	*
^{214}Th	10695	11				87	ms	10	0^+	09			1968	$\alpha\approx$100;β^+ ?	
^{214}Th^{m}	12876	11	2181.0	2.7		1.24	μs	0.12	8^+#	09			2007	IT=100	
^{214}Pa	19460	80				17	ms	3	7^+#	09	95Ni05	D	1995	$\alpha\approx$100	
*^{214}Pb^{m}	E : 1365 + x keV; x=20-90 keV from 12Go19														**
*^{214}Po	T : average 16Al28=163.47(0.03) 13Be31=163.6(0.3) 12Su11=164.2(0.6)														**
*^{214}Rn	T : from 19Pa45; other 70Va13=270(20)														**
*^{214}Fr	T : average 19Mi08=6.0(0.2) 15Kh09=5.9(0.4) 05Li17=4.6(0.7)														**
*^{214}Fr	T : 68To10=5.0(0.2) 68Va18=5.5(0.5)														**
*^{214}Fr	J : 16Fa11=(1)														**
*^{214}Fr^{n}	E : 516.6(6) keV above ^{214}Fr^{m}														**
*^{214}Fr^{p}	E : 6477 + y keV; y=100#(100#) keV estimated by Nubase														**
*^{214}Ra	T : average 15Kh09=2.36(0.06) 12No08=2.435(0.020) 73Be33=2.46(0.03)														**
*^{214}Ac	J : 17Gr18,16Fe11=5														**
*^{214}Ac	D : %β^+ from 68Va04<14 %														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{215}Hg	17110#	400#				600# ms >300ns	$9/2^+$#	13	10Al24	I	2010	β^- ?;β^-n ?	
^{215}Tl	10030#	300#				9.7 s 3.8	$1/2^+$#	13	17Ca12	TD	2010	β^-=100;β^-n=4.6 46	
^{215}Pb	4340	50				142 s 11	$9/2^+$#	13	17Ca12	T	1998	β^-=100	*
^{215}Bi	1629	6				7.62 m 0.13	$(9/2^-)$	13	14Mo02	T	1953	β^-=100	*
^{215}Bi^m	2996#	21#	1367#	20#		36.9 s 0.6	$(25/2^-)$	13			2001	IT=76.9 5;β^-=23.1 5	*
^{215}Po	−541.8	2.1				1.781 ms 0.005	$9/2^+$	13			1911	α=100;β^-=2.3e-4 2	
^{215}At	−1257	7				37 μs 3	$9/2^-$	13	18Sa45	T	1944	α=100	*
^{215}Rn	−1169	6				2.30 μs 0.10	$9/2^+$	13			1952	α=100	*
^{215}Fr	318	7				90 ns 4	$9/2^-$	13	19Mi08	T	1970	α=100	*
^{215}Ra	2532	7				1.669 ms 0.009	$9/2^+$#	13	18Di11	T	1967	α=100	*
^{215}Ra^m	4410	7	1877.8	0.3		7.31 μs 0.13	$(25/2^+)$	13	04He25	T	1983	IT=100	*
^{215}Ra^n	4779	7	2246.9	0.4		1.39 μs 0.07	$(29/2^-)$	13			1998	IT=100	
^{215}Ra^p	6340#	50#	3807#	50#		555 ns 10	$(43/2^-)$	13			1987	IT=100	*
^{215}Ac	6031	12				171 ms 10	$9/2^-$*	13	17Su18	TD	1968	$\alpha\approx$100;β^+=0.09 2	*
^{215}Ac^m	7827	12	1796.0	0.9		185 ns 30	$(21/2^-)$	13			1983	IT=100	
^{215}Ac^n	8520#	50#	2488#	50#		335 ns 10	$(29/2^+)$	13			1983	IT=100	*
^{215}Th	10921	6				1.35 s 0.14	$(1/2^-)$	13	19Zh54	T	1968	α=100	*
^{215}Th^m	12390#	50#	1471#	50#		770 ns 60	$9/2^+$#	13			2005	IT=100	*
^{215}Pa	17800	80				14 ms 2	$9/2^-$	13			1979	α=100	*
^{215}U	24890	100				1.4 ms 0.9	$5/2^-$#	15	15Ya13	T	2015	α=?;β^+ ?	*

*^{215}Pb T : average 17Ca12=98.4(30.8) 13De20=147(12) 14Mo02=160(40); **
*^{215}Pb T : other 96Ry.B=36(1) **
*^{215}Bi T : average 14Mo02=7.6(0.2) 90Ru02=7.7(0.2) 89Bu09=7.5(0.4) 65Nu03=7.4(0.6) **
*^{215}Bi^m E : 1347.5(0.2) + x keV; x=20#(20#) keV estimated by Nubase **
*^{215}At T : other 51Me10=100(20) **
*^{215}Rn T : other 18Sa45=2.5(0.3) **
*^{215}Fr T : average 19Mi08=101(15) 84De16=86(5) 84Sc25=104(16) 74No02-120(20) **
*^{215}Ra T : average 18Di11=1.64(0.08) 18Br13=1.66(0.07) 15Kh09=1.70(0.06) **
*^{215}Ra T : 05Li17=1.64(0.04) 00He17=1.67(0.01); other 20Su02=1.51(+0.40-0.26) **
*^{215}Ra^m T : average 04He25=7.6(0.2) 98St24=6.9(0.3) 88Fu10=7.2(0.2) **
*^{215}Ra^p E : 3756.6(0.4) + x keV; x=50#(50#) keV estimated by Nubase **
*^{215}Ac T : other 17Su18=193(+97-49) **
*^{215}Ac J : 17Gr18,16Fe11=9/2 **
*^{215}Ac^n E : 2438 + x keV; x=50#(50#) from Ensdf'2001 **
*^{215}Th T : average 19Zh54=1.5(2) 68Va18=1.2(2); other 07Le14=0.63(+1.26-0.21) **
*^{215}Th^m E : 1421.3(0.3) + x keV; x=50#(50#) keV estimated by Nubase **
*^{215}Pa J : favored α decay to ^{211}Ac (J=9/2-) **
*^{215}U T : symmetrized from 15Ya13=0.73(+1.33-0.29) ms **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{216}Hg	20920#	400#				2# s >300ns	0^+	11	10Al24	I	2010	β^- ?;β^-n ?	
^{216}Tl	14870#	300#				5.9 s 3.3	5^+#	11	17Ca12	TD	2010	β^-=100;β^-n<11.5	
^{216}Pb	7510#	200#				1.66 m 0.20	0^+	15	17Ca12	TD	2010	β^-=100	
^{216}Pb^m	9020#	200#	1514	20		400 ns 40	8^+#	15	12Go19	EJT	2012	IT=100	*
^{216}Bi	5874	11			*	2.21 m 0.04	$(6^-,7^-)$	07	14Mo02	T	1989	β^-=100	*
^{216}Bi^m	5898	15	24	19	MD*	6.6 m 2.1	3^-#	07			1989	β^-=100	
^{216}Po	1782.3	1.8				144.0 ms 0.6	0^+	07	17Na22	T	1910	α=100;2β^- ?	*
^{216}At	2257	4				300 μs 30	1^-	07			1948	$\alpha\approx$100;β^- ?;ε ?	
^{216}At^m	2417	10	161	11	AD	100# μs	9^-#	07			1971	α=100	
^{216}Rn	253	6				29 μs 4	0^+	07	18Sa45	T	1949	α=100	*
^{216}Fr	2971	4				700 ns 20	(1^-)	07			1970	α=100;β^+ ?	
^{216}Fr^m	3190	6	219	6	AD	850 ns 30	(9^-)		07Ku30	TJD	2007	$\alpha\approx$100;β^+ ?	
^{216}Ra	3291	8				172 ns 7	0^+	07	19Pa45	T	1972	α=100;ε<1e-8	*
^{216}Ac	8150	9				440 μs 16	(1^-)	07			1967	α=100;β^+ ?	
^{216}Ac^m	8188	10	38	5	AD	441 μs 7	(9^-)	07			1966	α=100;β^+ ?	
^{216}Ac^n	8570#	100#	422#	100#		~300 ns		07			2006	IT=100	*
^{216}Th	10299	11				26.28 ms 0.16	0^+	07	19Zh54	T	1968	$\alpha\approx$100;β^+ ?	*
^{216}Th^m	12340	12	2041	8	AD	135.4 μs 2.9	8^+	07	19Zh54	T	1983	IT=97.2 9;α=2.8 9	*
^{216}Th^n	12947	14	2648	8		580 ns 26	(11^-)	07	01Ha46	JT	1983	IT=100	*
^{216}Th^p	13981	14	3682	8		740 ns 70	(14^+)	07	05Ku31	TE	2001	IT=100	*
^{216}Pa	17824	25				105 ms 12	5^+#	07	19Zh23	T	1972	$\alpha\approx$100;β^+ ?	*
^{216}U	23066	28				6.9 ms 2.9	0^+	15	15Ma37	T	2015	α=100	*
^{216}U^m	25320	30	2250	40	AD	1.4 ms 0.9	8^+#	15	15Ma37	T	2015	α=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)	Excitation Energy (keV)	Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)

$*^{216}$Pb^m	E : 1459 + x keV; x=20-90 keV from 12Go19	**
$*^{216}$Bi	T : average 14Mo02=2.21(25) 00Ku06=2.25(0.05) 96Ry.B=2.17(0.05);	**
$*^{216}$Bi	T : other 90Ru02=3.6(0.4)	**
$*^{216}$Po	T : others 19Mi18=145(11) 18Ba44=136(6) 03Da24=144(8) 63Di05=145(2)	**
$*^{216}$Rn	T : other 61Ru06=45(5)	**
$*^{216}$Ra	T : average 19Pa45=161(11) 17Su18=167(53) 73No09=182(10)	**
$*^{216}$Ac^n	E : 322 + x keV, x=100#(100#) keV by Nubase	**
$*^{216}$Th	T : average 19Zh54=26.3(0.5) 05Ku31=26.0(0.2) 01Ha46=25.4(0.8)	**
$*^{216}$Th	T : 00He17=27.0(0.3) 68Va18=28(2); others 14Ya19=29(+13-7)	**
$*^{216}$Th	T : 05Li17=30(9) 00He17=30(3)	**
$*^{216}$Th^m	T : average 19Zh54=126(14) 05Ku31=135(4) 01Ha46=128(8) 00He17=140(5)	**
$*^{216}$Th^m	J : favored α decay to ^{214}Rn^m (J=8+)	**
$*^{216}$Th^n	E : 05Ku31=606.8(0.1) keV above ^{216}Th^m	**
$*^{216}$Th^n	T : average 05Ku31=570(30) 01Ha46=615(55)	**
$*^{216}$Th^p	E : 05Ku31=1641.4(0.7) keV above ^{216}Th^m	**
$*^{216}$Pa	T : average 19Zh23=92(+50-24) 96An21=105(12); others 98Ik01=150(70-40),	**
$*^{216}$Pa	T : 140(50-30) 79Sc09=170(100-40) 71Su14=200(40)	**
$*^{216}$U	T : average 15Ma37=4.72(+4.72-1.57) 15De22=3.8(+8.8-3.2)	**
$*^{216}$U^m	T : symmetrized from 15Ma37=0.74(+1.34-0.29)	**

^{217}Tl	18660#	400#				2#	s	>300ns	$1/2^+$#	18	10Al24	I	2010	β^- ?;β^-n ?	
^{217}Pb	12260#	300#				19.9	s	5.3	$9/2^+$#	18	17Ca12	TD	2010	β^-=100	
^{217}Bi	8730	18				98.5	s	1.3	$9/2^-$#	18			1998	β^-=100	
^{217}Bi^m	10221	27	1491	20		3.0	μs	0.2	$25/2^-$#	18			2012	IT=100	*
^{217}Po	5883	7				1.53	s	0.05	$(9/2^+)*$	18	04Li28	TJ	1956	α=97.5 14;β^-=2.5 14	*
^{217}At	4395	5				32.6	ms	0.3	$9/2^-*$	18	19Ba22	J	1947	α=99.992 2;β^-=0.008 2	*
^{217}Rn	3659	4				593	μs	38	$9/2^+$	18	18Sa45	T	1949	α=100	*
^{217}Fr	4315	7				22	μs	5	$9/2^-$	18			1968	α=100	
^{217}Ra	5890	7				1.95	μs	0.12	$(9/2^+)$	18	19Mi08	T	1970	α=100	*
^{217}Ac	8702	11				69	ns	4	$9/2^-$	18			1972	$\alpha\approx$100;β^+ ?	*
^{217}Ac^m	10715	18	2012	20		740	ns	40	$29/2^+$	18	85De14	DJT	1973	IT=95.49 18 10;α=4.51 18	
^{217}Th	12206	11				248	μs	4	$9/2^+$#	18	19Zh54	T	1968	α=100	*
^{217}Th^m	12879	11	673.3	0.1		141	ns	50	$(15/2^-)$	18			1989	IT=100	
^{217}Th^n	14510	30	2307	32		71	μs	14	$(25/2^+)$		05Ku31	ETJ	2002	IT=100	*
^{217}Pa	17055	12				3.8	ms	0.2	$9/2^-$	18			1968	α=100;β^- ?	*
^{217}Pa^m	18915	13	1860	7	AD	1.08	ms	0.03	$(23/2^-)$	18			1979	α=73 4;IT ?	
^{217}U	22970#	80#				850	μs	710	$1/2^-$#	18	05Le42	T	2000	$\alpha\approx$100;β^- ?	*

$*^{217}$Bi^m	E : 1436 + x keV; x=20-90 keV from 12Go19	**
$*^{217}$Po	T : average 03Ku25=1.53(0.03) 96Ry.B=1.47(0.05); other 04Li28=1.6(0.2)	**
$*^{217}$Po	J : 15Fi07=(9/2,11/2)	**
$*^{217}$Po	D : %β^- from 77Vy02<5	**
$*^{217}$At	D : %β^- average 97Ch53=0.0067(24)% 69Le.A=0.012(4)%	**
$*^{217}$Rn	T : average 18Sa45=670(60) 61Ru06=540(50)	**
$*^{217}$Ra	T : average 19Mi08=2.5(0.2) 19Ya04=1.4(+0.4-0.3) 90An19=1.7(0.3)	**
$*^{217}$Ra	T : 70Va13=1.6(0.2) 70To07=4(2)	**
$*^{217}$Ac	T : others 19Mi08=150(+370-60) 82GoZU=75(3) 73No09=111(7)	**
$*^{217}$Th	T : average 19Zh54=249(11) 15Kh09=259(12) 05Ku31=257(2) 02He29=237(2)	**
$*^{217}$Th	T : 00He17=248(3) 00Ni02=261(+22-18) 73Ha32=252(7); Birge ratio=2.95;	**
$*^{217}$Th	T : other 05Li17=310(70)	**
$*^{217}$Th^n	T : symmetrized from 05Ku31=67(+17-11); other 02Mu.A=20(5)	**
$*^{217}$Th^n	E : 2251.9 + x keV; x<110 keV in 05Ku31, due to the observed weak Kx rays	**
$*^{217}$Pa	J : favored α decay to ^{213}Ac (J=9/2-)	**
$*^{217}$U	T : symetrized from 05Le42=0.19(+1.13-0.10) ms; other 00Ma65=15.6(+21.3-5.7)	**

^{218}Tl	23710#	400#				1#	s		6^+#					β^- ?;β^-n ?	
^{218}Pb	15630#	300#				14.8	s	6.8	0^+	19	17Ca12	TD	2009	β^-=100	
^{218}Bi	13216	27				33	s	1	8^-#	19	04De16	JT	1998	β^-=100	*
^{218}Po	8356.7	2.0				3.097	m	0.012	0^+	19			1904	α=99.980 2;β^-=0.020 2	
^{218}At	8100	12				1.28	s	0.06	$(2^-,3^-)*$	19	19Ba22	J	1943	$\alpha\approx$100;β^- ?	
^{218}Rn	5217.4	2.3				33.75	ms	0.15	0^+	19			1948	α=100	
^{218}Fr	7059	4				1.4	ms	0.5	1^-	19	82Ew01	T	1949	α=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{218}Fr^m	7147	5	87	4	AD	21.9	ms	0.5	(8^-)	19	99Sh03	J	1982	$\alpha\approx$100;IT ?	
^{218}Ra	6646	10				25.91	μs	0.14	0^+	19			1970	α=100	
^{218}Ac	10850	60			*	1.00	μs	0.04	(1^-)	19	19Ya04	T	1970	α=100	*
^{218}Ac^m	10900	90	50	70	*	> 100#	ns		8^-#					IT ?;α ?;β^+ ?	
^{218}Ac^n	11460#	110#	607#	86#		103	ns	11	(11^+)	19			1994	IT=100	*
^{218}Th	12367	11				122	ns	5	0^+	19			1973	α=100	
^{218}Pa	18650	18				108	μs	5	8^-#	19	20Zh01	TDJ	1979	α=100	*
^{218}Pa^m	18731	20	81	19	AD	150	μs	50	1^-#	19	20Zh01	TDJ	1979	α=100	*
^{218}U	21895	14				354	μs	91	0^+	19	18Ya01	T	1992	α=100	*
^{218}U^m	24004	18	2109	17	AD	408	μs	125	8^+#	19	18Ya01	T	2005	$\alpha\approx$100; IT=?	*

*^{218}Bi T : others 17Ca12=38.5(21.6) 14Mo02=33(6) **
*^{218}Fr T : symmetrized from 82Ew01=1.3(+0.5-0.4) **
*^{218}Ac T : average 19Ya04=1.04(0.12) 15Kh09=0.96(0.05) 89Mi17=1.06(0.09) **
*^{218}Ac T : 83Sc23=1.12(0.11) 17Su18=0.98(0.12). others 19Mi08=1.5(0.1),1.8(0.1) **
*^{218}Ac^n E : 507.0(0.3) + x keV above ^{218}Ac^m; x=50#(50#) keV by Nubase **
*^{218}Pa T : average 20Zh01=107(5) 00He17=113(10), supersedes 96An21=110(20) **
*^{218}Pa^m T : symmetrized from 20Zh01=135(+62-32) **
*^{218}U T : average 18Ya01=131(+179-48) 05Le42=510(+170-100) **
*^{218}U^m T : average 18Ya01=134(+244-53) 05Le42=560(+260-140); other (not used) **
*^{218}U^m T : 15Ma37=280(+1300-120) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{219}Pb	20620#	400#				3#	s	>300ns	$11/2^+$#	11	10Al24	I	2009	β^- ?	
^{219}Bi	16320#	200#				8.7	s	2.9	$9/2^-$#	12	17Ca12	T	2009	β^-=100;β^-n ?	*
^{219}Po	12681	16				10.3	m	1.0	$9/2^+$#	15	15Fi07	T	1998	β^-=71.8 20;α=28.2 20	*
^{219}At	10396	3				56	s	3	$(9/2^-)*$	16	19Ba22	J	1953	α=93.6 10;β^-=6.4 10	*
^{219}Rn	8829.3	2.1				3.96	s	0.01	$5/2^+*$	01			1903	α=100	
^{219}Fr	8617	7				22.5	ms	1.7	$9/2^-*$	01	18Sa45	T	1948	α=100	*
^{219}Ra	9394	7				9	ms	2	$(7/2)^+$	01	18Sa45	TJD	1952	α=100	*
^{219}Ra^m	9411	7	16.7	0.8		10	ms	3	$(11/2)^+$	01	18Sa45	TJD	2018	$\alpha\approx$100; IT ?	
^{219}Ac	11570	50				9.4	μs	1.0	$9/2^-$	01	19Mi08	T	1970	α=100;β^+ ?	*
^{219}Th	14460	60				1.023	μs	0.018	$9/2^+$#	12	19Ya04	T	1973	α=100;β^+ ?	*
^{219}Pa	18580	70				56	ns	9	$9/2^-$	01	17Su18	TD	2005	α=100;β^+ ?	*
^{219}U	23296	13				60	μs	7	$9/2^+$#	01	19Zh54	T	1993	α=100;β^+ ?	*
^{219}Np	29440	90				570	μs	450	$9/2^-$#	16	18Ya01	T	2015	α=100	*

*^{219}Bi T : other 12Be28t=22(7) **
*^{219}Po T : from 15Fi07=620(59) s **
*^{219}At J : 19Ba22=(9/2) **
*^{219}At D : %α from 15Fi07 **
*^{219}Fr T : average 18Sa45=28(3) 51Me10=20(2) **
*^{219}Fr J : 15De28,20Ba29=9/2 **
*^{219}Ra T : from 18Sa45=8(2) and 10(3) for E(α)=7.98 MeV and 7.66 MeV **
*^{219}Ra^m T : from 18Sa45 for E(α)=7.68 MeV **
*^{219}Ac T : average 19Mi08=7.6(+2.1-1.4) 89Mi17=11.8(1.5) 70Bo13=7(2) **
*^{219}Th T : average 19Ya04=1.03(0.03) 18Br13=0.94(0.08) 17Su18=1.09(0.08) **
*^{219}Th T : 15Kh09=0.97(0.04) 73Ha32=1.05(0.03); others 20Su02=0.94(+0.21-0.15) **
*^{219}Th T : 19Zh54=1.24(0.68-0.32) **
*^{219}Pa T : average 17Su18=60(+28-15) 87Fa.A=53(10) **
*^{219}U T : others 93An07=42(+34-13) 05Le42=80(+100-30) **
*^{219}Np T : symmetrized from 18Ya01=150(+720-70) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{220}Pb	24130#	400#				1#	s	>300ns	0^+	11	10Al24	I	2010	β^- ?	
^{220}Bi	20960#	300#				9.5	s	5.7	1^-#	11	17Ca12	TD	2010	β^-=100;β^-n ?	
^{220}Po	15263	18				10#	s	>300ns	0^+	11	98Pf02	I	1998	β^- ?	
^{220}At	14376	14				3.71	m	0.04	3^-#	11			1989	β^-=92 2;α=8 2	
^{220}Rn	10612.0	1.8				55.6	s	0.1	0^+	11			1900	α=100;2β^- ?	*
^{220}Fr	11482	4				27.4	s	0.3	1^+*	11			1948	$\alpha\approx$100;β^-=0.35 5	*
^{220}Ra	10272	8				18.1	ms	1.2	0^+	11	18Sa45	T	1949	α=100	*
^{220}Ac	13744	6				26.36	ms	0.19	(3^-)	11	97Sh09	J	1970	α=100;β^+ ?	*
^{220}Th	14690	14				10.2	μs	0.3	0^+	11	19Pa45	T	1973	α=100;ε ?	*
^{220}Pa	20278	15			*	0.85	μs	0.06	1^-#	11	20Ma27	T	2005	α=100;β^+ ?	*
^{220}Pa^m	20304	22	26	23	AD*	410	ns	180			18Hu13	ET	2018	α=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{220}Pa^{n}	20570	50	290	50	AD	260	ns	210			18Hu13	ET	2018	α=100	*
^{220}U	23010#	100#				60#	ns		0^+					α ?;β^+ ?	
^{220}Np	30480	30				29	ns	11	1^-#		19Zh23	TD	2019	α=100	*
*^{220}Rn	T : other 18Ba44=58(4)														**
*^{220}Fr	J : other 14Ly01=1														**
*^{220}Ra	T : average 18Sa45=19(3) 00He17=18(2) 90An19=17(2) 61Ru06=23(5)														**
*^{220}Ac	T : average 90An19=26.4(0.2) 70Bo13=26.1(0.5)														**
*^{220}Th	T : average 19Pa45=10.4(0.4) 73Ha32=9.7(0.6)														**
*^{220}Pa	T : average 20Ma27=0.73(0.11) 19Ya04=0.91(0.10) 17Hu08=0.90(0.13);														**
*^{220}Pa	T : others 19Zh54=0.98(+0.40-0.22) 87Fa.A=0.780(0.16)														**
*^{220}Pa^{m}	T : symmetrized from 18Hu13=308(+250-95)														**
*^{220}Pa^{n}	T : symmetrized from 18Hu13=69(+330-30)														**
*^{220}Np	T : symmetrized 19Zh23=25(+14–7)														**
^{221}Bi	24200#	300#				2#	s	>300ns	$9/2^-$#	11	10Al24	I	2009	β^- ?;β^-n ?	
^{221}Po	19774	20				2.2	m	0.7	$9/2^+$#	13			2010	β^-=100	*
^{221}At	16783	14				2.3	m	0.2	$3/2^-$#	07			1989	β^-=100	
^{221}Rn	14471	6				25.7	m	0.5	$7/2^+$*	07	97Li23	T	1956	β^-=78 1;α=22 1	*
^{221}Fr	13277	5				4.801	m	0.005	$5/2^-$*	07	13Su13	T	1947	$\alpha\approx$100;β^-=0.0048 15; 14C=8.8e-11 11	*
^{221}Ra	12964	5				25	s	4	$5/2^+$*	07	18Sa45	T	1949	α=100;14C=1.2e-10 9	*
^{221}Ac	14530	60				52	ms	2	$9/2^-$#	07			1968	α=100	
^{221}Th	16940	8				1.75	ms	0.02	$7/2^+$#	07	14Lo10	T	1970	α=100	*
^{221}Pa	20370	60				5.9	μs	1.7	$9/2^-$	07			1983	α=100	*
^{221}U	24520	70				660	ns	140	$9/2^+$#	15			2015	$\alpha\approx$100;β^+ ?	
^{221}Np	29910#	200#				30#	ns		$9/2^-$#					α ?	
^{221}Pu	35930#	300#				100#	μs		$9/2^+$#					α ?;SF ?	
*^{221}Po	T : symmetrized from 10Ch19=112(+58-28) s														**
*^{221}Rn	J : other 83Ah03=5/2														**
*^{221}Fr	D : %β^- from 97Ch53; %^{14}C from 94Bo28														**
*^{221}Fr	T : average 13Su13=4.806(0.006) 10Wa42=4.768(0.017) 07Je07=4.79(0.02)														**
*^{221}Fr	J : other 14Ly01,15De28=5/2														**
*^{221}Ra	T : average 18Sa45=16(2) 58To25=28(2) 51Me10=30(2); Birge ratio=3.79														**
*^{221}Ra	D : %^{14}C from 94Bo28														**
*^{221}Th	T : average 14Lo10=1.78(0.03) 01Ko07=1.73(0.03) 70To07=1.68(0.06); others														**
*^{221}Th	T : 19Mi08=1.0(0.2) 19Ya04=2.28(+0.70-0.43) 05Li17=2.3(0.4)														**
*^{221}Th	T : 00He17=2.0(+0.3-0.2)														**
*^{221}Pa	T : other 19Mi08=3.5(+8.5-1.4)														**
^{222}Bi	28950#	300#				3#	s	>300ns	1^-#		10Al24	I	2009	β^- ?;β^-n ?	
^{222}Po	22490	40				9.1	m	7.2	0^+	11			2010	β^-=100	*
^{222}At	20953	16				54	s	10		11			1989	β^-=100	
^{222}Rn	16372.0	1.9				3.8215	d	0.0002	0^+	11	15Be07	T	1899	α=100	*
^{222}Fr	16378	7				14.2	m	0.3	2^-*	11			1975	β^-=100	
^{222}Ra	14320	4				33.6	s	0.4	0^+	11	12Po13	T	1948	α=100;14C=3.0e-8 10	*
^{222}Ac	16622	5			*	5.0	s	0.5	1^-	11			1949	α=99 1;β^+=1 1	
^{222}Ac^{m}	16700	21	78	21	AD*	1.05	m	0.05	5^+#	11	72Es03	DTJ	1972	$\alpha\approx$98.6 4;$\beta^+\approx$1.4 4;IT ?	*
^{222}Th	17203	10				2.24	ms	0.03	0^+	11			1970	α=100;ε ?	
^{222}Pa	22060	90				3.8	ms	0.2	1^-#	11	19Mi08	T	1970	α=100	*
^{222}U	24270	50				4.7	μs	0.7	0^+	15			1983	α=100;β^+ ?	
^{222}Np	31270	40				480	ns	190	1^-#		20Ma27	TD	2020	α=100	*
^{222}Pu	35060#	300#				10#	μs		0^+					α ?;SF ?	
*^{222}Po	T : symmetrized from 10Ch19=145(+694-66) s														**
*^{222}Rn	T : rounded from 15Be07=3.82146(16stat,4syst)=3.82146(0.00016)														**
*^{222}Ra	T : others (not used) 95Ko54=36.17(0.10) 82Bo04=43(4)														**
*^{222}Ac^{m}	D : %β^+ from 0.7 < 72Es03 < 2														**
*^{222}Pa	T : average 19Mi08=4.5(0.3) 95Ni.A=3.3(0.3) 79Sc09=2.9(+0.6-0.4); other														**
*^{222}Pa	T : 70Bo13=5.7(0.5) conflicting (not used)														**
*^{222}Np	T : symmetrized from 20Ma27=380(+260-110)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{223}Bi	32240#	400#				1# s >300ns	$9/2^-$#	11	10Al24	I	2009	β^- ?;β^-n ?	
^{223}Po	27080#	200#				6# s >300ns	$11/2^+$#	11	10Al24	I	2010	β^- ?	
^{223}At	23428	14				50 s 7	$3/2^-$#	01			1989	$\beta^-\approx$100;α ?	
^{223}Rn	20390	8				24.3 m 0.4	$7/2^+*$	01			1964	β^-=100;α ?	*
^{223}Fr	18382.3	1.9				22.00 m 0.07	$3/2^-*$	01			1939	$\beta^-\approx$100;α=0.006	
^{223}Ra	17233.2	2.1				11.4352 d 0.0010	$3/2^+*$	01	15Ko06	T	1905	α=100;14C=8.9e-8 4	*
^{223}Ac	17825	7				2.10 m 0.05	$(5/2^-)$	01			1948	$\alpha\approx$99;ε ?	
^{223}Th	19385	8				600 ms 20	$(5/2)^+$	01			1952	α=100	
^{223}Pa	22340	80				5.3 ms 0.3	$9/2^-$	01	19Mi08	T	1970	α=100;β^+ ?	*
^{223}U	26050	60				65 μs 12	$7/2^+$#	01	20Su02	T	1991	α=100;β^+ ?	*
^{223}Np	30660	80				2.5 μs 0.8	$(9/2^-)$		17Su18	TJD	2017	α=100	*
^{223}Pu	36120#	300#				10# μs	$9/2^+$#					α ?;SF ?	
^{223}Am	42700#	300#				10 ms 9	$9/2^-$#		15De22	TI	2015	$\alpha\approx$100;β^+ ?	*
*^{223}Rn	J : other 83Ah03=3/2												**
*^{223}Ra	T : average 15Ko06=11.4362(0.0050) 15Be13=11.447(0.006) 15Be13=11.445(0.013)												**
*^{223}Ra	T : 15Co02=11.4358(0.0028) 65Ki05=11.4346(0.0011)												**
*^{223}Ra	J : other 18Ly01=3/2												**
*^{223}Pa	T : average 19Mi08=7(1) 99Ho28=4.9(0.4) 95Ni.A=5.0(1.0) 70Bo13=6.5(1.0)												**
*^{223}Pa	J : favored α decay to ^{219}Ac (J=9/2-)												**
*^{223}U	T : symmetrized from 20Su02=62(+14-10); other 91An10=18(+10-5)												**
*^{223}Np	T : symmetrized from 17Su18=2.15(+1.00–0.52)												**
*^{223}Am	T : symmetrized from 15De22=5.2(+12.0-4.4)												**
^{224}Bi	37070#	400#				1# s >300ns	1^-#	15	10Al24	I	2010	β^- ?;β^-n ?	
^{224}Po	29910#	200#				3# m >300ns	0^+	15	10Al24	I	2010	β^- ?	
^{224}At	27711	22				2.5 m 1.5	2^+#	15	10Ch19	T	2010	β^-=100	*
^{224}Rn	22445	10				107 m 3	0^+	15			1964	β^-=100	
^{224}Fr	21749	11				3.33 m 0.10	1^-*	15			1969	β^-=100	
^{224}Fr^x	21850#	100#	100#	100#	MD	*contamnt*							
^{224}Ra	18825.8	1.8				3.6316 d 0.0014	0^+	15	21Be.A	T	1902	α=100;14C=4.0e-9 12	*
^{224}Ac	20234	4				2.78 h 0.16	(0^-)	15			1948	β^+=90.5 17;α=9.5 17;β^- ?	*
^{224}Th	19996	10				1.04 s 0.02	0^+	15			1949	α=100;2β^+ ?	
^{224}Pa	23862	8				844 ms 19	(5^-)	15			1958	$\alpha\approx$100;β^+ ?	*
^{224}U	25743	15				396 μs 17	0^+	15	14Lo10	T	1991	α=100;β^+ ?	
^{224}Np	32032	29				48 μs 19	2^-#		18Hu13	T	2018	α=100	*
^{224}Pu	35280#	300#				10# μs	0^+					α ?;SF ?	
^{224}Am	43260#	400#				1# ms						α ?;SF ?	
*^{224}At	T : symmetrized from 10Ch19=76(+138-23) s, value for q=84+ ions												**
*^{224}Ra	T : average 21Be.A=3.6321(0.0028, NIST-IC) 3.6323(0.0027, NIST-Ge)												**
*^{224}Ra	T : 3.6262(0.0048, NPL-Ge) 04Sc04=3.6319(0.0023, PTβ^-IC)												**
*^{224}Ac	D : %α symmetrized from 51Me10=9.1(+2.0-1.4)%												**
*^{224}Pa	T : average 97Wi15=850(20) 96Li05=790(60); other 70Bo13=950(150)												**
*^{224}Pa	J : favored α decay to J=(5-) level at 68.71 keV in ^{220}Ac												**
*^{224}Np	T : symmetried from 18Hu13=38(+26-11)												**
^{225}Po	34580#	300#				10# s >300ns	$3/2^+$#	11	10Al24	I	2010	β^- ?	
^{225}At	30300#	300#				3# s >300ns	$1/2^+$#	11	10Al24	I	2010	β^- ?;β^-n ?	
^{225}Rn	26534	11				4.66 m 0.04	$7/2^-*$	09			1969	β^-=100	*
^{225}Fr	23821	12				3.95 m 0.14	$3/2^-*$	09			1969	β^-=100	
^{225}Ra	21993.0	2.6				14.82 d 0.19	$1/2^+*$	09	87Mi10	T	1947	β^-=100	*
^{225}Ac	21637	5				9.9190 d 0.0021	$3/2^-$	09	20Ko06	T	1947	α=100;14C=5.3e-10 13	*
^{225}Th	22310	5				8.75 m 0.04	$3/2^+$	09	89Ac01	J	1949	$\alpha\approx$90;ε ?	*
^{225}Pa	24360	80				1.71 s 0.10	$5/2^-$#	09			1958	α=100	*
^{225}U	27372	10				62 ms 4	$5/2^+$#	09	19Mi08	T	1989	α=100	*
^{225}Np	31620	90				6.5 ms 3.5	$9/2^-$#	09	15De22	T	1994	α=100;β^+ ?	*
^{225}Pu	36300#	300#				100# μs	$7/2^+$#					α ?;SF ?	
^{225}Am	42390#	400#				100# μs	$9/2^-$#					α ?;SF ?	
*^{225}Rn	J : other 83Ah03=1/2												**
*^{225}Ra	J : other 18Ly01=1/2												**
*^{225}Ra	T : average 87Mi10=15.02(0.56) 50Ha52=14.8(0.2)												**
*^{225}Ac	T : average 20Ko06=9.9179(0.0030) 12Po14=9.920(0.003)												**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{225}$Ac	J : also favored α decay to J=3/2- level at 552.1 keV in ^{221}Fr													**
$*^{225}$Th	J : favored α decay to J=3/2+ level at 321.4 keV in ^{221}Ra													**
$*^{225}$Th	D : %α from 51Me10													**
$*^{225}$Th	T : from 87Mi10; other 51Me10=8.0(0.5)													**
$*^{225}$Pa	T : average 70Bo13=1.8(0.3) 78IbZZ=1.7(0.1)													**
$*^{225}$U	T : average 19Mi08=63(7) 00He17=59(+5-2); others 03Ni10=135(+93-39)													**
$*^{225}$U	T : 01Ku07=84(4) 94An02=68(+45-20) 92To02=95(15) 89He13=80(+40-10)													**
$*^{225}$Np	T : average 15De22=3.8(+7.6-2.7)(^{233}Bk decay) 3.3(+7.6-0.7)													**
$*^{225}$Np	T : (^{229}Am decay); other: 19Mi08=0.31(+0.75-0.13)													**
^{226}Po	37550#	400#			1#	m	>300ns	0^+	11	10Al24	I	2010	β^- ?	
^{226}At	34660#	300#			7#	m	>300ns	2^+#	11	10Al24	I	2010	β^- ?;β^-n ?	
^{226}Rn	28747	10			7.4	m	0.1	0^+	96			1969	β^-=100	
^{226}Fr	27521	6			48.5	s	0.7	1^-*	96	86Bo35	T	1969	β^-=100	*
^{226}Ra	23667.6	1.9			1.600	ky	0.007	0^+	96	90We01	D	1898	α=100;14C=2.6e-9 6;2β^- ?	*
^{226}Ac	24309	3			29.37	h	0.12	(1^-)	96			1950	β^-=83 3;ε=17 3; α=0.006 2	
^{226}Th	23198	4			30.70	m	0.03	0^+	96	01Bo11	D	1948	α=100;18O<3.2e-12	*
^{226}Pa	26034	11			1.8	m	0.2	1^-#	96			1949	α=74 5;β^+=26 5	
^{226}U	27329	11			269	ms	6	0^+	14	01Ca.B	T	1973	α=100	*
^{226}Np	32820	100			35	ms	10		96	19Mi08	T	1990	α=100;β^+ ?	*
^{226}Pu	35630#	200#			10#	ms		0^+					α ?;SF ?	
^{226}Am	42970#	300#			100#	μs							α ?;SF ?	
$*^{226}$Fr	T : average 75Ra03=48(1) 86Bo35=49(1)													**
$*^{226}$Ra	D : %^{14}C average 90We01=2.3(0.8)e-9% 86Ba26=2.9(1.0)e-9%													**
$*^{226}$Ra	D : 85Ho21=3.2(1.6)e-9%													**
$*^{226}$Th	T : from 12Po13; others 87Mi10=30.57(0.10) 95Ko54=30.83(0.01)													**
$*^{226}$U	T : average 01Ca.B=258(13) 00He17=281(9) 99Gr28=260(10); other													**
$*^{226}$U	T : 18Mi11=400(100)													**
$*^{226}$Np	T : average 19Mi08=48(5) 90Ni05=35(10); other 95Le15=58(+70-20)													**
^{227}Po	42280#	400#			2#	s	>300ns	$5/2^+$#	16			2010	β^- ?	
^{227}At	37430#	300#			5#	s	>300ns	$1/2^+$#	16			2010	β^- ?;β^-n ?	
^{227}Rn	32886	14			20.2	s	0.4	$(3/2^+)*$	16	83Ah03	J	1986	β^-=100	
^{227}Fr	29682	6			2.47	m	0.03	$1/2^+*$	16			1972	β^-=100	
^{227}Ra	27177.5	1.9			42.2	m	0.5	$3/2^+*$	16			1953	β^-=100	*
^{227}Ac	25849.5	1.9			21.772	y	0.003	$3/2^-*$	16			1851	β^-=98.62 36;α=1.38 36	*
^{227}Th	25804.8	2.1			18.693	d	0.004	$(1/2^+)$	16	19Ko06	T	1906	α=100	*
^{227}Pa	26830	7			38.3	m	0.3	$(5/2^-)$	16			1948	α=85 2;ε=15 2	
^{227}U	29045	9			1.1	m	0.1	$(3/2^+)$	16			1952	α=100;β^+ ?	
^{227}Np	32580	80			510	ms	60	$5/2^+$#	16			1990	$\alpha\approx$100;β^+ ?	
^{227}Pu	36770#	100#			2#	s		$5/2^+$#					α ?	
^{227}Am	42180#	200#			20#	ms		$9/2^-$#					α ?;SF ?	
$*^{227}$Ra	J : 18Ly01,88Ah02,83Ah03,87We03=3/2													**
$*^{227}$Ac	J : other 17Gr18,16Fe11=3/2													**
$*^{227}$Th	T : average 19Ko06=18.681(0.009) 15Co11=18.695(0.004)													**
^{228}At	41880#	400#			1#	m	>300ns	3^+#	14	10Al24	I	2010	β^- ?;β^-n ?	
^{228}Rn	35243	18			65	s	2	0^+	14			1989	β^-=100	
^{228}Fr	33384	7			38	s	1	2^-*	14			1972	β^-=100	
^{228}Fr^m	34390	30	1004	30	180	s	110			08Ch.A	TIE	2008	IT ?;β^- ?	*
^{228}Ra	28940.2	2.0			5.75	y	0.03	0^+	14			1907	β^-=100	
^{228}Ac	28894.7	2.1			6.15	h	0.02	3^+*	14			1908	β^-=100	
^{228}Ac^m	29430	30	539	30	180	s	70			08Ch.A	TIE	2008	IT ?;β^- ?	*
^{228}Th	26770.9	1.8			1.9125	y	0.0007	0^+	14	93Bo20	D	1905	α=100;20O=1.13e-11 22	*
^{228}Pa	28924	4			22	h	1	3^+	14			1948	β^+=98.15 17;α=1.85 17	
^{228}U	29220	13			9.1	m	0.2	0^+	14	61Ru05	TD	1949	α=97.5 1.4;ε=2.5 14	*
^{228}Np	33830#	100#			61.4	s	1.4	4^+#	14	94Kr13	D	1994	ε=59 7;α=41 7; β^+SF=0.012 6	*
^{228}Pu	36108	23			2.1	s	1.3	0^+	14	03Ni10	T	1994	$\alpha\approx$100;β^+ ?	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{228}Am	42850#	200#			100#	ms							α ?;SF ?	
*^{228}Fr^m	T : symmetrized from 08Ch.A=94(+170-29) s													**
*^{228}Ac^m	T : symemtrized from 08Ch.A=149(+95-42) s													**
*^{228}Th	T : average 14Un01=698.4(0.4) 71Jo14=698.77(0.32) 56Ki16=697.6(0.7)													**
*^{228}U	D : %ε from 61Ru05$<$5%													**
*^{228}Np	D : %β^+SF from 94Kr13=0.020(9) relative to %ε=59(7); %α=40(+8-6)													**
*^{228}Np	D : %β^+=60(+6-8), derived from β^+/α=1.5(4) in 94Kr13													**
*^{228}Pu	T : symmetrized from 03Ni10=1.1(+2.0-0.5)													**
^{229}At	44890#	400#			1#	s	$>$300ns	$1/2^+$#	11	10Al24	I	2010	β^- ?;β^-n ?	
^{229}Rn	39362	13			11.9	s	1.3	$(5/2^+)$*	09	83Ah03	J	2009	β^-=100	*
^{229}Fr	35668	5			50.2	s	0.4	$(1/2^+)$	08	14Bu06	J	1975	β^-=100	*
^{229}Ra	32562	15			4.0	m	0.2	$5/2^+$*	08			1975	β^-=100	*
^{229}Ac	30690	12			62.7	m	0.5	$3/2^+$	08	77Th04	J	1952	β^-=100	
^{229}Th	29585.5	2.4			7.916	ky	0.017	$5/2^+$*	08	18Es07	T	1947	α=100	*
^{229}Th^m	29585.5	2.4	0.0082	0.0001	7	μs	1	$(3/2^+)$	08	19Ya18	E	1994	IT=100	*
^{229}Pa	29897	3			1.55	d	0.04	$5/2^+$	08	18Gr09	TD	1949	ε=99.51 5;α=0.49 5	*
^{229}Pa^m	29909	3	12.20	0.04	420	ns	30	$3/2^-$	08	15Ah04	EJD	1982	IT=100	*
^{229}U	31211	6			57.8	m	0.5	$3/2^+$	08	15Ah04	T	1949	$\beta^+\approx$80;$\alpha\approx$20	*
^{229}Np	33800	100			4.00	m	0.18	$5/2^+$#	08	04Sa05	TD	1968	α=68 11;β^+ ?	*
^{229}Np^p	33960#	110#	160#	50#				$5/2^-$#						
^{229}Pu	37390	60			91	s	26	$3/2^+$#	08	10Kh06	TD	1994	$\alpha\approx$50 20;$\beta^+\approx$50 20;SF$<$7	*
^{229}Am	42180	110			1.8	s	1.5	$5/2^-$#	15			2015	$\alpha\approx$100;β^+ ?	*
^{229}Am^p	42440#	230#	260#	200#										
*^{229}Rn	T : symmetrized from 09Ne03=12.0(+1.2-1.3)													**
*^{229}Fr	T : 92Bo05=50.2(0.4); Ensdf2008=50.2(2.0) is misprint													**
*^{229}Fr	J : strong β^- feeding to 1/2+ (142.8 keV) and 1/2- (479.2 keV) in 92Bo05													**
*^{229}Ra	J : other 18Ly01=5/2													**
*^{229}Th	T : average 18Es07=7.825(0.087) 14Va04=7.917(0.024) 11Ki16=7.932(0.028)													**
*^{229}Th	T : 89Go19=7.880(0.060); other 50Ha52=7.340(0.080)													**
*^{229}Th^m	T : 17Se01=7(1) us from internal conversion vs time (nickel alloy surface);													**
*^{229}Th^m	T : others 19Sh38=10(8) (oxide or hydroxide source) 16We07$>$60 s													**
*^{229}Th^m	T : (for 2+ charge state) 09In01(1 m$<$T1/2$<$3 m) 09Ki14$<$2 h													**
*^{229}Th^m	T : 03Mi02 (same group as 09Ki14)=13.9(3.0)h 01Br20(T1/2$<$6 h or T1/2$>$20 d)													**
*^{229}Th^m	T : 94He08=70(50)h. 19Ve05 (metallic host) excludes 4 us$<$T1/2$<$50 us isomer													**
*^{229}Th^m	E : rounded from 8.15(0.10) eV, average 20Si22=8.10(0.17) eV													**
*^{229}Th^m	E : 20Ge.A=8.09(+0.14-0.19) eV 19Se13=8.28(0.03,stat)(0.16,syst) eV													**
*^{229}Th^m	E : 19Ya18=8.30(0.45,stat)(0.81,syst) eV 07Be16=8.1(0.5) eV, recalibrated													**
*^{229}Th^m	E : in 19Ye18 from 7.5(0.5) eV; others 16We07 (6.3$<$E$<$18.3) eV													**
*^{229}Th^m	E : 94He08=3.5(1.0) eV													**
*^{229}Pa	T : average 87Ah05=1.50(0.05) 18Gr09=1.67(0.08), determined by evaluator													**
*^{229}Pa	T : as unweighted average (Birge ratio=4.88) from 8 values in 18Gr09													**
*^{229}Pa	D : %α average 87Ah05=0.48(0.05) 18Gr09=0.53(0.10)													**
*^{229}Pa^m	D : from 98Le15													**
*^{229}Pa^m	T : from 82Ah08, time-difference between Pa K x rays and 80-400 eV electrons													**
*^{229}U	J : favored α decay to ^{225}Th (J=3/2+)													**
*^{229}Np	T : average 04Sa05=4.0(0.4) 68Ha14=4.0(0.2)													**
*^{229}Pu	T : average 10Kh06=67(+41-19) 01Ca.B=90(+71-27)													**
*^{229}Am	T : symmetrized from 15De22=0.9(+2.1-0.7); also 15De22=6.4(+14.9-5.4)													**
^{230}Rn	42170#	200#			24#	s	$>$300ns	0^+	12	10Al24	I	2010	β^- ?	
^{230}Fr	39487	7			19.1	s	0.5	2^+#	12			1987	β^-=100	
^{230}Ra	34516	10			93	m	2	0^+	12			1978	β^-=100	
^{230}Ac	33838	16			122	s	3	(1^+)	12			1973	β^-=100;β^-SF=1.2e-6 4	
^{230}Th	30862.5	1.2			75.4	ky	0.3	0^+	12			1907	IS=0.02 2;α=100;SF$<$4e-12; 24Ne=5.8e-11 13	
^{230}Pa	32174	3			17.4	d	0.5	2^-	14			1948	β^+=92.2 7;β^-=7.8 7; α=0.0032 1	
^{230}U	31615	5			20.23	d	0.02	0^+	12	12Po12	T	1948	α=100;22Ne=4.8e-12 20; SF ?	
^{230}Np	35240	60			4.6	m	0.3	4^+#	12			1968	$\beta^+<$97;$\alpha>$3	

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Nuclide	Mass excess (keV)		Excitation Energy (keV)		Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{230}Pu	36932	14			105	s	10	0^+	12	18Mi11	T	1990	$\alpha\approx100;\beta^+$?	*
^{230}Am	42870#	140#			40	s	9	1^-#	12	17Wi13	TD	2003	$\beta^+\approx100;\beta^+$SF>30	*
*^{230}Pu	T : average 18Mi11=200(+77-43) 01Ca.B=102(10)													**
*^{230}Am	T : average 17Wi13=36(+15-8) 16Ka13td=32(+22-9)													**
^{231}Rn	46550#	300#			2#	s	>300ns	$1/2^+$#	13	10Al24	I	2010	β^- ?	
^{231}Fr	42081	8			17.6	s	0.6	$(1/2^+)$	13	14Bu06	J	1985	β^-=100	
^{231}Ra	38216	11			104	s	1	$(5/2^+)$*	13	06Bo33	T	1983	β^-=100	*
^{231}Ra^m	38282	11	66.21	0.09	~53	μs		$(1/2^+)$	13			2001	IT=100	
^{231}Ac	35763	13			7.5	m	0.1	$1/2^+$	13			1973	β^-=100	
^{231}Th	33815.8	1.2			25.52	h	0.01	$5/2^+$	13			1911	β^-=100	
^{231}Pa	33424.3	1.8			32.65	ky	0.20	$3/2^-$*	13	20Je01	T	1918	IS=100;α=100;SF<3e-10; 24Ne=13.4e-10 17;..	*
^{231}U	33806.0	2.7			4.2	d	0.1	$5/2^+$#	13			1949	$\varepsilon\approx100;\alpha$=0.004 1	
^{231}Np	35620	50			48.8	m	0.2	$5/2^+$#	13			1950	β^+=98 1;α=2 1	
^{231}Pu	38309	22			8.6	m	0.5	$(3/2^+)$	13			1999	β^+ ?;α=13 5	*
^{231}Am	42410#	300#			1#	m		$5/2^-$#					β^+ ?;α ?	
^{231}Cm	47270#	300#			20#	s		$3/2^+$#					β^+ ?;α ?	
*^{231}Ra	J : 18Ly01=(5/2)													**
*^{231}Pa	T : average 20Je01=32.57(0.13) 69Ro33=32.765(0.110) 68Br04=32.340(0.115)													**
*^{231}Pa	T : 61Ki05=32.643(260) 49Va02=34.3(0.3); Birge ratio=3.12													**
*^{231}Pu	D : %α symmetrized from 99La14=10(+7-3)%; β^+ not observed directly													**
^{232}Fr	46073	14			5.5	s	0.6	(5)	06	04Pe17	J	1990	β^-=100;β^-SF ?	
^{232}Ra	40497	9			4.0	m	0.3	0^+	06	08Ch.A	T	1983	β^-=100	*
^{232}Ac	39154	13			1.98	m	0.08	(1^+)	06			1986	β^-=100	
^{232}Th	35446.7	1.4			14.0	Gy	0.1	0^+	06	95Bo18	D	1898	IS=99.98 2;α=100; SF=1.1e-9 4; 24Ne+26Ne<2.78e-10;2β^- ?	*
^{232}Pa	35947	8			1.32	d	0.02	(2^-)	06			1949	$\beta^-\approx100;\varepsilon$?	
^{232}U	34609.4	1.8			68.9	y	0.4	0^+	06			1949	α=100;24Ne=8.9e-10 7; SF=2.7e-12 6;28Mg<5e-12	*
^{232}Np	37360#	100#			14.7	m	0.3	(5^-)	06			1950	$\beta^+\approx100;\alpha$?	*
^{232}Pu	38361	17			33.7	m	0.5	0^+	06			1973	ε=?;α<20	*
^{232}Am	43420#	300#			1.31	m	0.04	1^-#	06	90Ha28	D	1967	$\beta^+\approx97;\alpha$?;β^+SF=0.069 10	
^{232}Cm	46330#	200#			10#	s		0^+					β^+ ?;α ?	
*^{232}Ra	T : average 08Ch.A=4.00(0.33) 86Gi08=4.2(0.8)													**
*^{232}Th	D : %^{24}Ne+^{26}Ne from 95Bo18; %SF from 00Ho27													**
*^{232}Np	J : favored α decay from ^{236}Am (J=5-)													**
*^{232}Pu	T : average 00La25=33.1(0.8) 73Ja06=34.1(0.7)													**
^{233}Fr	48920	20			900	ms	100	$1/2^+$#	20			2010	β^-=100;β^-n ?	
^{233}Ra	44334	9			30	s	5	$1/2^+$#	20			1990	β^-=100	
^{233}Ac	41308	13			143	s	10	$(1/2^+)$	20			1983	β^-=100	
^{233}Th	38731.6	1.4			21.83	m	0.04	$1/2^+$	20			1935	β^-=100	
^{233}Th^m	38737.7	1.4	6.06	0.02	2#	s		$7/2^-$#					IT ?;β^- ?	*
^{233}Pa	37489.4	1.3			26.975	d	0.013	$3/2^-$*	20			1938	β^-=100	
^{233}U	36919.1	2.3			159.19	ky	0.15	$5/2^+$*	20			1947	α=100;SF<6e-11; 24Ne=7.2e-11 9; 28Mg<1.3e-13	*
^{233}Np	37950	50			36.2	m	0.1	$5/2^+$#	20	50Ma14	D	1950	$\beta^+\approx100;\alpha\approx0.0007$	*
^{233}Np^p	38000#	60#	50#	30#				$(5/2^-)$						
^{233}Pu	40050	50			20.9	m	0.4	$5/2^+$#	20			1957	$\beta^+\approx100;\alpha$=0.12 5	
^{233}Am	43290#	110#			3.2	m	0.8	$5/2^-$#	20	00Sa52	TD	2000	β^+ ?;α=4.5 9	*
^{233}Cm	47290	80			27	s	10	$3/2^+$#	20	10Kh06	TD	2001	α=20 10;β^+=80 10	*
^{233}Bk	52770#	230#			40	s	30	$3/2^-$#	20	15De22	TD	2015	$\alpha\approx82;\beta^+$?	*
*^{233}Th^m	J : from expected conf=n7/2[743]													**
*^{233}Th^m	T : from B(E3:7/2- ->1/2+)(^{233}Th)=B(E3: 1/2+ -> 7/2-)(^{235}U)/4 with													**
*^{233}Th^m	T : T1/2(^{235}U)=25.7(0.1) m and α_T(^{235}U)=2.79(0.05)e20													**
*^{233}Th^m	T : and α_T(^{233}Th)=3.36(0.09)e9													**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{233}Np	D : %α observed in 50Ma14 with β^+/α=1.5e5														**
*^{233}Am	D : %α combining 10Kh06<6 and 00Sa52>3														**
*^{233}Cm	T : symmetrized from 10Kh06=23(+13-6)														**
*^{233}Bk	T : symmetrized from 15De22=21(+48-17)														**
^{234}Ra	46931	8				30	s	10	0^+	07			1990	β^-=100;β^-SF ?	
^{234}Ac	44841	14				45	s	2	1^+#	07	08Ch.A	T	1986	β^-=100	*
^{234}Ac^m	44980	30	140	30		> 93	s				08Ch.A	TE	2008	β^- ?;IT ?	
^{234}Ac^n	45460	30	620	30		180	s	70			08Ch.A	TE	2008	β^- ?;IT ?	*
^{234}Th	40613.0	2.6				24.107	d	0.024	0^+	07	18Pa45	T	1900	β^-=100;α ?	*
^{234}Pa	40339	4				6.70	h	0.05	4^+	07			1913	β^-=100	
^{234}Pa^m	40417.9	2.8	79	3	IT	1.159	m	0.011	(0^-)	07	73Go40	E	1951	$\beta^-\approx$100;IT=0.16 4	*
^{234}U	38145.0	1.1				245.5	ky	0.6	0^+	07			1912	IS=0.0054 5;α=100; SF=1.64e-9 22; 28Mg=1.4e-11 3; 24Ne+26Ne=9e-12 7	*
^{234}U^m	39566.3	1.1	1421.257	0.017		33.5	μs	2.0	6^-	07			1963	IT=100	
^{234}Np	39955	8				4.4	d	0.1	(0^+)	07			1949	β^+=100	
^{234}Pu	40350	7				8.8	h	0.1	0^+	07			1949	$\varepsilon\approx$94;$\alpha\approx$6	
^{234}Am	44460#	160#				2.32	m	0.08	0^-#	07	90Ha02	D	1967	$\beta^+\approx$100;α=0.039 12; β^+SF=0.0066 18	*
^{234}Cm	46722	17				52	s	9	0^+	07	10Kh06	D	2001	$\beta^+\approx$71;$\alpha\approx$27;SF$\approx$2	*
^{234}Bk	53400#	150#				20	s	5	3^-#	07	16Ka13	T	2003	α>80;β^+<20	*
*^{234}Ac	I : 08Ch.A reports two isomers with T1/2>93 s and T1/2=149(+95-42) s														**
*^{234}Ac^n	T : symmetrized from 08Ch.A=145(+95-42)														**
*^{234}Th	T : average 18Pa45=24.157(0.073) 48Kn23=24.101(0.025) 39Sa11=24.1(0.2)														**
*^{234}Pa^m	E : from 73Go40<10 keV above (3+) level at 73.92(0.02)														**
*^{234}Am	T : also 04Sa05=3.5(1.3), not used														**
*^{234}Cm	T : average 16Ka13=49(+15-9) 01Ca.B=51(12)														**
*^{234}Bk	T : symmetrized from 16Ka13=19(+6-4)														**
^{235}Ra	51130#	300#				5#	s		$5/2^+$#					β^- ?	
^{235}Ac	47357	14				62	s	4	$1/2^+$#	14	08Ch.A	T	2006	β^-=100	
^{235}Th	44018	13				7.2	m	0.1	$1/2^+$#	14			1969	β^-=100	
^{235}Pa	42289	14				24.4	m	0.2	$3/2^-$	14	77Th04	J	1950	β^-=100	
^{235}U	40918.8	1.1				704	My	1	$7/2^-$*	14			1935	IS=0.7204 6;α=100; SF=7e-9 2;20Ne=8e-10 4; 25Ne$\approx$8e-10;28Mg=8e-10	*
^{235}U^m	40918.9	1.1	0.0767	0.0001		25.7	m	0.1	$1/2^+$	14	18Po07	E	1966	IT=100	*
^{235}U^n	43420	300	2500	300		3.6	ms	1.8		14			2007	SF$\approx$100; IT ?	
^{235}Np	41043.0	1.4				396.1	d	1.2	$5/2^+$	14			1949	ε=99.99740 13;; α=0.00260 13	
^{235}Pu	42182	21				25.3	m	0.5	$(5/2^+)$	14			1957	β^+=99.9972 7;α=0.0028 7	
^{235}Am	44620	50				10.3	m	0.6	$5/2^-$#	14			1996	β^+=99.60 5;α=0.40 5	
^{235}Cm	48010#	100#				7	m	3	$5/2^+$#	14	20Kh10	TD	1981	β^+ ?;α=4 3	*
^{235}Bk	52770#	400#				1#	m		$3/2^-$#					β^+ ?;α ?	
*^{235}U^m	E : rounded from 18Po07=0.076737 (0.000018) keV														**
*^{235}U^m	T : from 16Ch11; value depends on the chemical environment														**
*^{235}Cm	T : symmetrized from 20Kh10=300(+250-100)s														**
*^{235}Cm	D : %α determined from 0<%α<8 in 20Kh10														**
^{236}Ac	51220	40				4.5	m	3.6	3^+#	15	10Ch19	T	2010	β^-=100	*
^{236}Th	46255	14				37.3	m	1.5	0^+	15			1973	β^-=100	
^{236}Pa	45334	14				9.1	m	0.1	$1(^-)$	06			1963	β^-=100;β^-SF=6e-8 4	*
^{236}U	42444.6	1.1				23.42	My	0.04	0^+	06			1951	α=100;SF=9.4e-8 4	
^{236}U^m	43497.1	1.3	1052.5	0.6		100	ns	4	4^-	06			1973	IT=100	
^{236}U^n	45195	3	2750	3		120	ns	2	(0^+)	06			1969	IT=87 6;SF=13 6;α ?	
^{236}Np	43380	50			*	153	ky	5	(6^-)	06			1949	ε=86.3 8;β^-=13.5 8; α=0.16 4	
^{236}Np^m	43438	7	60	50	IT*	22.5	h	0.4	(1^-)	06			1949	ε=50 3;β^-=50 3	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{236}Np^{p}	43616	14	240	50	AD				(3^{-})	06					
^{236}Pu	42901.5	1.8				2.858	y	0.008	0^{+}	06	90Og01	D	1949	α=100;SF=1.9e-7 4; 28Mg=2e-12;2β^{+} ?	
^{236}Pu^{m}	44087.0	1.8	1185.45	0.15		1.2	μs	0.3	5^{-}	06			2005	IT=100	
^{236}Am	46040#	120#				3.6	m	0.1	5^{-}	06	04Sa05	D	1998	$\beta^{+}\approx$100;α=4.0e-3 1	
^{236}Am^{m}	46090#	130#	50#	50#		2.9	m	0.2	(1^{-})	06			2004	$\beta^{+}\approx$100;α ?	
^{236}Cm	47853	18				6.8	m	0.8	0^{+}	06	10Kh06	TD	2010	β^{+}=82 2;α=18 2;SF ?	
^{236}Bk	53540#	360#				26	s	10	4^{+}#	16	17Ko02	TD	2017	$\beta^{+}\approx$100;α ?;β^{+}SF=0.04 2	*
*^{236}Ac	T : symmetrized from 10Ch19=72(+345-33) s														**
*^{236}Pa	D : β^{-}SF decay questioned in 90Ha02														**
*^{236}Bk	T : symmetrized from 17Ko02=22(+13-6); other 20Po07$\sim$19														**
^{237}Ac	54020#	400#				23#	s		1/2^{+}#					β^{-} ?	
^{237}Th	49955	16				4.8	m	0.5	5/2^{+}#	06			1993	β^{-}=100	
^{237}Pa	47528	13				8.7	m	0.2	1/2^{+}	06	77Th04	J	1954	β^{-}=100	
^{237}U	45390.1	1.2				6.752	d	0.002	1/2^{+}	06			1940	β^{-}=100	
^{237}U^{m}	45664.1	1.6	274.0	1.0		155	ns	6	7/2^{-}	06			1968	IT=100	*
^{237}Np	44871.6	1.1				2.144	My	0.007	5/2^{+}*	06	89Pr.A	D	1948	α=100;SF<2e-10; 30Mg<4e-12	*
^{237}Np^{m}	45816.8	1.1	945.20	0.10		710	ns	40	13/2^{-}	06	90St29	JED	1990	IT=100	*
^{237}Pu	45091.7	1.7				45.64	d	0.04	7/2^{-}	06			1949	ε=99.9958 4;α=0.0042 4	
^{237}Pu^{m}	45237.2	1.7	145.543	0.008		180	ms	20	1/2^{+}	06			1972	IT=100	
^{237}Pu^{n}	47990	250	2900	250		1.1	μs	0.1		06			1970	SF$\approx$100; IT ?	
^{237}Am	46570#	60#				73.6	m	0.8	5/2^{-}	06			1970	β^{+}=99.975 3;α=0.025 3	
^{237}Cm	49250	70				> 10#	m		5/2^{+}#	06	06As03	DT	2002	β^{+} ?;α=?	*
^{237}Cm^{p}	49450#	170#	200#	150#					7/2^{-}#		20Kh10	E			*
^{237}Bk	53210#	230#				2#	m		3/2^{-}#					β^{+} ?;α ?	
^{237}Cf	57940	100				0.8	s	0.2	5/2^{+}#	06	10Kh06	TD	1995	α=70 10;SF=30 10;β^{+} ?	*
*^{237}U^{m}	J : E1 to 5/2+														**
*^{237}Np	D : also cluster (Z=10-14) emission 92Mo03<1.8e-12%														**
*^{237}Np^{m}	J : multiple decay branches in 90St29 agree with J=11/2,13/2-, but the														**
*^{237}Np^{m}	J : absence of gamma rays to J=7/2- and 9/2+ argues agains J=11/2														**
*^{237}Cm	T : partial T1/2(α) 06As03=1100 m and by assuming %α=1														**
*^{237}Cm^{p}	E : 50(1) keV E1 gamma above the ^{237}Cm gs in 20Kh10														**
*^{237}Cf	T : other (not used) 95La09=2.1(0.3)														**
^{238}Th	52530#	280#				9.4	m	2.0	0^{+}	15			1999	β^{-}=100	
^{238}Pa	50894	16				2.28	m	0.09	3^{-}#	15	85Ba57	D	1968	β^{-}=100;β^{-}SF<2.6e-6	
^{238}U	47307.7	1.5				4.463	Gy	0.003	0^{+}	15	18Pa45	T	1896	IS=99.2742 10;α=100; SF=5.44e-5 7; 2β^{-}=2.2e-10 3	*
^{238}U^{m}	49865.6	1.6	2557.9	0.5		280	ns	6	0^{+}	15			1979	IT=97.4 4;SF=2.6 4	
^{238}Np	47454.6	1.1				2.099	d	0.002	2^{+}*	15			1949	β^{-}=100	
^{238}Np^{m}	49760#	200#	2300#	200#		112	ns	39		15			1970	SF$\approx$100;IT ?	
^{238}Pu	46163.1	1.1				87.7	y	0.1	0^{+}	15	89Wa10	D	1949	α=100;SF=1.9e-7 1; 32Si$\approx$1.4e-14; 28Mg+30Mg$\approx$6e-15	*
^{238}Am	48420	60				98	m	3	1^{+}	15	72Ah04	TD	1950	β^{+}=100;α=1.0e-4 4	
^{238}Am^{m}	50920#	210#	2500#	200#		35	μs	18		15			1967	SF$\approx$100;IT ?	
^{238}Cm	49445	12				2.2	h	0.4	0^{+}	15			1994	ε ?;α=3.84 18; SF=0.048 2	
^{238}Bk	54220#	260#				2.40	m	0.08	1#	15	94Kr03	TD	1994	$\beta^{+}\approx$100;α ?;β^{+}SF=0.048 2	
^{238}Cf	57280#	300#				21.1	ms	1.3	0^{+}	15	10Kh06	D	1995	SF=97.5 14;α=2.5 14	*
*^{238}U	T : average 18Pa45=4.456(0.021),														**
*^{238}U	T : 4.468(0.005), adjusted in 04Sc03 from 71Ja07=4.4683(0.0024),														**
*^{238}U	T : 4.457(0.004), adjusted in 04Sc03 from 59St45=4.460(0.005),														**
*^{238}U	T : 4.51(0.02), adjusted in 04Sc03 from 55Ko13=4.507(0.009),														**
*^{238}U	T : 4.495(0.018), adjusted in 04Sc03 from 49Ki26=4.490(0.005).														**
*^{238}U	D : %2β^{-}=2.2(3)e-10%, derived from T1/2(2ν-$\beta\beta$)=2.0(0.6) Zy in 91Tu02;														**
*^{238}U	D : %SF=5.44(0.07)e-5%, derived from T1/2(SF)=8.2(0.1) Py in 00Ho27														**
*^{238}Cf	D : %α from 10Kh06<5%														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{239}Th	56500#	400#				1# m	$7/2^+$#					β^- ?	
^{239}Pa	53340#	200#				1.8 h 0.5	$1/2^+$#	14			1995	β^-=100	
^{239}U	50572.7	1.5				23.45 m 0.02	$5/2^+$	14			1937	β^-=100	
^{239}U^m	50706.5	1.5	133.7991	0.0010		780 ns 40	$1/2^+$	14			1975	IT=100	
^{239}U^n	53070#	900#	2500#	900#		> 250 ns		14	94Ob0	1IT	1994	SF ?; IT ?	*
^{239}Np	49311.0	1.3				2.356 d 0.003	$5/2^+$*	14			1940	β^-=100;α ?	
^{239}Pu	48588.2	1.1				24.11 ky 0.03	$1/2^+$*	14			1946	α=100;SF=3.1e-10 6	
^{239}Pu^m	48979.8	1.1	391.584	0.003		193 ns 4	$7/2^-$	14			1955	IT=100	
^{239}Pu^n	51690	200	3100	200		7.5 μs 1.0	$(5/2^+)$	14			1970	SF≈100;IT ?	
^{239}Am	49390.4	2.0				11.9 h 0.1	$5/2^-$	14			1949	ε=99.990 1;α=0.010 1	*
^{239}Am^m	51890	200	2500	200		163 ns 12	$(7/2^+)$	14			1969	SF≈100;IT ?	
^{239}Cm	51150	150				2.5 h 0.4	$7/2^-$#	14	02Sh.C	TD	1952	β^+≈100;α=6.2e-3 14	
^{239}Cm^p	51390#	180#	240#	100#		> 100# ns	$1/2^+$					IT ?;β^+	*
^{239}Bk	54250#	210#			*	100# s	$(7/2^+)$	14	10An08	TD	1989	β^+≈100;α<0.01;SF<0.01	*
^{239}Bk^p	54290#	210#	41	11	AD*	> 30# μs	$(3/2^-)$		89Ha27	J	1989	IT ?;β^+ ?	
^{239}Cf	58200#	120#				28 s 2	$5/2^+$#	14	20Kh10	TD	1981	α=65 3;β^+ ?	*
^{239}Es	63630#	300#				1# s	$3/2^-$#					α ?;β^+ ?;SF ?	

*^{239}U^n T : other 94Ob01<0.3 ns is less likely **
*^{239}Am J : favored α decay to J=5/2- level at 49.10 keV in ^{235}Np **
*^{239}Cm^p E : 146 keV in ^{237}Pu, N=143 isotone **
*^{239}Bk J : from 89Ha27 **
*^{239}Cf T : other 81Mu12=39(+37-12) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{240}Pa	57010#	200#				20# s	3^+#					β^- ?	
^{240}U	52715.5	2.6				14.1 h 0.1	0^+	08			1953	β^-=100;α ?	
^{240}Np	52316	17			*	61.9 m 0.2	(5^+)	08			1953	β^-=100	
^{240}Np^m	52334	13	18	14	IT*	7.22 m 0.02	(1^+)	08	81Hs02	E	1948	β^-=99.88 1;IT=0.12 1	
^{240}Pu	50125.3	1.1				6.561 ky 0.007	0^+	08	18Be29	D	1949	α=100;SF=5.796e-6 39; 34Si<1.3e-11	*
^{240}Pu^m	51434.0	1.1	1308.74	0.05		165 ns 10	5^-	08			1967	IT=100	*
^{240}Am	51510	14				50.8 h 0.3	(3^-)	08			1949	β^+=100;α≈1.9e-4 7	
^{240}Am^m	54510	200	3000	200		940 μs 40		08			1967	SF≈100;IT ?	
^{240}Cm	51724.2	1.9				30.4 d 3.7	0^+	08	08Qi03	T	1949	α≈100;ε ?;SF=3.9e-6 8	*
^{240}Bk	55660#	150#				4.8 m 0.8	7^-#	08	83Ga05	D	1980	β^+ ?;α ?;β^+SF=0.0020 13	*
^{240}Bk^p	55900#	180#	240#	100#			*am*						
^{240}Cf	57989	18				40.3 s 0.9	0^+	08	10As.A	T	1970	α=98.5 2;SF=1.5 2;β^+ ?	*
^{240}Es	64230#	370#				6.0 s 1.7	4^-#		17Ko02	TD	2017	α=70 1;β^+=30 1; β^+SF=0.16 6	*

*^{240}Pu D : also %SF=5.632(0.062)e-6 from T1/2(SF)=116.5(1.3) Gy in 13Sa65 **
*^{240}Pu^m J : M1 to 4- and 6- **
*^{240}Cm T : from 08Qi03; other Ensdf2009=27(1), based on 49Se01=26.8 and 67Ba42=28 **
*^{240}Cm T : values that are reported without uncertainties **
*^{240}Bk D : %β^+SF symmetrized from 83Ga05=0.0013(+18-7)% **
*^{240}Cf D : α, %SF from 10Kh06; other $\alpha\sim$9, %SF$\sim$2 in 95La09 **
*^{240}Es T : average 20Po07=4.7(+3.8-1.4) 17Ko02=6(2); other 20Kh08=8(+6-2) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{241}Pa	59740#	300#				28# m	$1/2^+$#					β^- ?	
^{241}U	56200#	200#				4# m	$7/2^+$#	15				β^- ?	
^{241}Np	54320	100				13.9 m 0.2	$(5/2^+)$	15			1959	β^-=100;α ?	
^{241}Pu	52955.1	1.1				14.329 y 0.029	$5/2^+$*	15			1949	β^-≈100;α=0.00245 8; SF<2.4e-14	*
^{241}Pu^m	53116.8	1.1	161.6853	0.0009		880 ns 50	$1/2^+$	15			1975	IT=100	
^{241}Pu^n	55160	200	2200	200		20.5 μs 2.2		15			1970	SF=100	
^{241}Am	52934.3	1.1				432.6 y 0.6	$5/2^-$*	15			1949	α=100;SF=3.6e-10 9	
^{241}Am^m	55130	200	2200	200		1.2 μs 0.3		15	71Br39	E	1969	SF=100	
^{241}Cm	53701.8	1.6				32.8 d 0.2	$1/2^+$	15			1952	ε=99.0 1;α=1.0 1	
^{241}Bk	55980#	170#				4.6 m 0.4	$(7/2^+)$	15			2003	β^+=?;α ?	
^{241}Bk^p	56030#	170#	51	3	AD	> 25# μs	$(3/2^-)$	15				IT ?	
^{241}Cf	59330#	170#				2.35 m 0.18	$7/2^-$#	15	20Kh10	D	1970	β^+ ?;α=15 1	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{241}Cf^{p}	59480#	200#	150#	100#	Nm				$1/2^{+}$#	15					
^{241}Es	63890#	230#				5.1	s	0.8	$3/2^{-}$#	15	20Kh08	TD	1996	$\alpha\approx$100;β^{+} ?	*
^{241}Es^{p}	64120#	250#	230#	100#					*am*						
^{241}Fm	69220#	300#				730	μs	60	$5/2^{+}$#	15	08Kh10	TD	2008	SF=?;α<14;β^{+}<12	
*^{241}Pu	D : %α from β^{-}/α=2.45(0.08)e-5 in 68Ah01														**
*^{241}Cf	T : from 10As.A=141(11) s; other 70Si19=3.78(0.70) m														**
*^{241}Es	T : symmetrized from 20Kh08=4.3(+2.4-1.2); other 96Ni09=8(+6-4)														**
^{242}U	58620#	200#				16.8	m	0.5	0^{+}	02			1979	β^{-}=100	
^{242}Np	57420	200			*	2.2	m	0.2	(1^{+})	02			1979	β^{-}=100	
^{242}Np^{m}	57470#	210#	50#	50#	*	5.5	m	0.1	(6^{+})	02			1981	β^{-}=100	
^{242}Pu	54716.9	1.2				375	ky	2	0^{+}	02	18Be29	D	1950	α=100;SF=5.510e-4 41	*
^{242}Am	55468.0	1.1				16.02	h	0.02	1^{-}*	02			1949	β^{-}=82.7 3;ε=17.3 3	
^{242}Am^{m}	55516.6	1.1	48.60	0.05		141	y	2	5^{-}	02			1950	IT=99.55 2;α=0.45 2;	
														SF<4.7e-9	
^{242}Am^{n}	57670	80	2200	80		14.0	ms	1.0	$(2^{+},3^{-})$	02			1962	SF$\approx$100;IT=?	
^{242}Cm	54803.7	1.1				162.8	d	0.2	0^{+}	02			1949	α=100;SF=6.2e-6 3;	*
														34Si=1.1e-14 4;2β^{+} ?	
^{242}Cm^{m}	57600	100	2800	100		180	ns	70		02			1971	SF ?;IT ?	
^{242}Bk	57750#	140#				7.0	m	1.3	3^{+}#	02	80Ga07	D	1972	$\beta^{+}\approx$100;β^{+}SF<3e-5;α ?	
^{242}Bk^{m}	59750#	240#	2000#	200#		600	ns	100		02			1972	SF$\approx$100;IT ?	
^{242}Bk^{p}	57900	90	150#	100#					4^{-}						
^{242}Cf	59387	13				3.49	m	0.15	0^{+}	02	70Si19	T	1967	α=61 3;β^{+}=39 3;SF<0.014	*
^{242}Es	64800#	260#				17.8	s	1.6	2^{+}#	02	10An08	TD	1994	α=57 3;β^{+}=43 3;	*
														β^{+}SF=0.6 2	
^{242}Fm	68400#	400#				800	μs	200	0^{+}	02			1975	SF$\approx$100;α ?	*
*^{242}Pu	D : %SF other 13Sa65=5.564(0.072)e-4 from T1/2(SF) 13Sa65=67.4(0.9) Gy														**
*^{242}Cm	D : %^{34}Si symmetrized from 1.0(+4-3)e-14														**
*^{242}Cf	T : average 70Si19=3.68(0.44) 67Si07=3.4(0.2) 67Fi04=3.2(0.5)														**
*^{242}Cf	T : 67Il01=3.7(0.3)														**
*^{242}Cf	D : %α from 11Ve03; other 81Mu12=80(20)														**
*^{242}Es	T : others 00Sh10=11(3) 96Ni09=16(+6-4)														**
*^{242}Es	D : %β^{+}SF from 00Sh10; other 10An08=1.3(+1.2-0.7)														**
*^{242}Fm	T : 08Kh10 excludes 4 us-1s (conflicting)														**
^{243}U	62480#	300#				16#	m		$9/2^{-}$#					β^{-} ?	
^{243}Np	59810#	30#				1.85	m	0.15	$5/2^{+}$#	14			1979	β^{-}=100	
^{243}Np^{p}	59926	10	120#	30#	Nm				$5/2^{-}$#						
^{243}Pu	57754.6	2.5				4.9553	h	0.0025	$7/2^{+}$	14	19Le09	T	1951	β^{-}=100	*
^{243}Pu^{m}	58138.2	2.5	383.64	0.25		330	ns	30	$(1/2^{+})$	14			1975	IT=100	
^{243}Am	57175.0	1.4				7.350	ky	0.009	$5/2^{-}$*	14	20Ma.A	T	1950	α=100;SF=3.7e-9 9	*
^{243}Am^{m}	59480	200	2300	200		5.5	μs	0.5		14			1970	SF$\approx$100;IT ?	
^{243}Cm	57181.9	1.5				29.1	y	0.1	$5/2^{+}$*	14			1950	$\alpha\approx$100;ε=0.29 3;	
														SF=5.3e-9 9	
^{243}Cm^{m}	57269.3	1.5	87.4	0.1		1.08	μs	0.03	$1/2^{+}$	14			1971	IT=100	
^{243}Cm^{p}	57285	15	103	15	AD				$(7/2^{+})$	14			1984	IT ?	
^{243}Bk	58690	5			*	4.6	h	0.2	$3/2^{-}$	14	18Ah01	J	1950	$\beta^{+}\approx$100;$\alpha\approx$0.15	
^{243}Bk^{p}	58710	19	20	20	AD*	> 30#	μs		$(7/2^{+})$					IT$\approx$100;β^{+} ?	
^{243}Cf	60990#	180#				10.8	m	0.3	$(1/2^{+})$	14	18Ko05	T	1967	$\beta^{+}\approx$86 3;$\alpha\approx$14 3	*
^{243}Es	64750#	210#			*	22.1	s	1.4	$(7/2^{+})$	14	10An08	JTD	1973	α=61 6;β^{+} ?;SF<1	*
^{243}Es^{m}	64800#	220#	50#	50#	*	> 50#	μs		$3/2^{-}$#		10An08	I		IT ?;α ?;β^{+} ?	
^{243}Fm	69320#	130#				231	ms	9	$7/2^{-}$#	14	20Kh10	D	1981	α=91 3;SF=9 3;β^{+} ?	*
*^{243}Pu	T: average 19Le09=4.948(10) 69Ho10=4.958(5) 68Di09=4.955(3)														**
*^{243}Am	T : average 20Ma.A=7342(14),7345(14) y 07Ag02=7364(22) y, deduced from														**
*^{243}Am	T : T1/2(^{243}Am)=7357(23) y and T1/2(^{241}Am)=432.6(0.6) y,														**
*^{243}Am	T : 74Po17=7380(34) y 68Br22=7336.9(57.2),7390(50) y														**
*^{243}Cf	T : average 18Ko05=10.9(0.5) 67Fi04=12.5(1.0) 67Si08=10.3(0.5)														**
*^{243}Cf	D : %α,%β^{+} from I(7060α)/I(7171α)$\approx$2.5 in														**
*^{243}Cf	D : 67Fi04 and (β^{+}+α)/I(7060α)=10(2) in 67Si08														**
*^{243}Es	T : average 19Br06=24(3) 10An08=23(3) 89Ha27=21(5) 73Es02=21(2)														**
*^{243}Es	J : from 10An08														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
*^{243}Es	D : %α from 10An08; SF was not observed														**
*^{243}Fm	D : %β^+ 20Kh10,08Kh10<10%														**
^{244}Np	63240#	100#				2.29	m	0.16	7^-#	17			1987	β^-=100	
^{244}Pu	59806.0	2.3				81.3	My	0.3	0^+	17			1954	α=99.877 6;SF=0.123 6; $2\beta^-$<7.3e-9	
^{244}Pu^m	61022.0	2.4	1216.0	0.5		1.75	s	0.12	8^-	17	15Ko14	E	2016	IT=100	
^{244}Am	59879.1	1.5				10.01	h	0.03	(6^-)	17	19Tr05	T	1950	β^-=100	
^{244}Am^m	59968.4	1.4	89.3	1.6	RQ	26.13	m	0.43	1^+	17	19Tr05	T	1950	β^-=99.9636 13; ε=0.0364 13	
^{244}Am^n	61880#	200#	2000#	200#		900	μs	150		17			1967	SF≈100;IT ?	
^{244}Am^p	62080#	200#	2200#	200#		~6.5	μs			17			1969	SF≈100;IT ?	
^{244}Cm	58451.8	1.1				18.11	y	0.03	0^+	17			1950	α=100;SF=1.37e-4 2	
^{244}Cm^m	59492.0	1.1	1040.181	0.011		34	ms	2	6^+	17			1963	IT=100	
^{244}Cm^n	59550#	900#	1100#	900#		> 500	ns			17			1969	SF≈100;IT ?	
^{244}Bk	60714	14				5.02	h	0.03	4^-	17	18Ah01	J	1972	β^+ ?;α=0.006 3	
^{244}Bk^m	62210#	500#	1500#	500#		820	ns	60		17			1972	SF≈100;IT ?	
^{244}Bk^p	60850#	50#	140#	50#					*am*						
^{244}Cf	61478.1	2.6				19.5	m	0.5	0^+	17	18Ko05	TD	1956	α=75 6;ε=25 6	*
^{244}Es	66030#	180#				37	s	4	6^+#	17	02Sh02	D	1973	β^+=95 3;α=5 3; β^+SF=0.011 4	*
^{244}Fm	68960#	200#				3.12	ms	0.08	0^+	17	08Kh10	D	1967	SF>97;β^+<2;α<1	
^{244}Md	75600#	370#				0.36	s	0.14	3^+#		20Kh08	IDT	2020	α≈100;β^+ ?;β^+SF<14	*
^{244}Md^m	75800#	400#	200#	150#		~9	μs		7^+#		20Kh08	ITD	2020	IT=?;β^+ ?	*
*^{244}Cf	T : average 18Ko05=19.3(1.2) 67Si08=19.4(0.6) 67Fi04=20.4(1.6)														**
*^{244}Es	D : %α symmetrized from 73Es02=4(+3-2)%; %SF from														**
*^{244}Es	D : β^+SF/β^+=1.2(0.4)e-4 in 02Sh02														**
*^{244}Md	T : symmetrized from 20Kh08=0.30(+0.19-0.09); other 20Po07=0.4(+0.4-0.1),														**
*^{244}Md	T : suggested in 21He.A to be associated with ^{245}Md decay														**
*^{244}Md	I : reported in both 20Po07 and 20Kh08, but 21He.A conclude that 20Po07														**
*^{244}Md	I : results are associated with ^{245}Md. Also, 20Po07 assigned this														**
*^{244}Md	I : level as an isomer. The proposed ground state in 20Po07, associated														**
*^{244}Md	I : with E(α)=8.3 MeV and T1/2~6 s, is tentative and not														**
*^{244}Md	I : trusted by Nubase. It was not confirmed in 20Kh08														**
*^{244}Md^m	D : possible %β^+~44 in 20Kh08 is speculative														**
^{245}Np	65850#	200#				6#	m		$5/2^+$#					β^- ?	
^{245}Pu	63178	14				10.5	h	0.1	$(9/2^-)$	11			1955	β^-=100	
^{245}Pu^m	63443	14	264.5	0.3		330	ns	20	$(5/2^+)$	11			2007	IT=100	
^{245}Pu^n	65180	400	2000	400		90	ns	30		11			1971	SF≈100;IT ?	
^{245}Am	61900.4	1.9				2.05	h	0.01	$5/2^+$	11			1955	β^-=100	
^{245}Am^m	64300#	400#	2400#	400#		640	ns	60		11			1972	SF≈100;IT ?	
^{245}Cm	61004.5	1.1				8.25	ky	0.07	$7/2^+$*	11	12Ch30	T	1954	α=100;SF=6.1e-7 9	
^{245}Cm^m	61360.4	1.1	355.92	0.10		290	ns	20	$1/2^+$	11			1975	IT=100	
^{245}Bk	61813.8	1.8			*	4.95	d	0.03	$3/2^-$	11			1951	ε=99.88 10;α=0.12 1	
^{245}Bk^p	61860#	30#	50#	30#	*	> 20#	μs		$(7/2^+)$					IT ?;ε ?	
^{245}Cf	63385.2	2.4				45.0	m	1.5	$1/2^+$	11			1956	β^+=64.7 25;α=35.3 25	
^{245}Cf^p	63442	5	57	4		> 100#	ns		$(7/2^+)$	11	11Lo06	E	2004	IT=100	
^{245}Es	66320#	170#			*	1.11	m	0.06	$(3/2^-)$	11	19Br06	TD	1967	β^+=51 6;α=49 6	*
^{245}Es^m	66350#	170#	30#	15#	*	> 50#	μs		$7/2^+$#	11			1967	IT ?;β^+ ?;α ?	
^{245}Es^p	66600	160	283#	15#	IT				$(7/2^-)$	11			2005	IT=100	*
^{245}Es^q	66640#	190#	330#	100#					$(1/2^-)$						
^{245}Fm	70190#	200#				4.2	s	1.3	$1/2^+$#	11	20Kh10	D	1967	α≈100;β^+<7;SF<0.3	
^{245}Md	75330#	260#			*&	0.38	s	0.10	$(7/2^-)$	11	20Kh08	TD	1996	α≈100;β^+ ?	*
^{245}Md^m	75430#	280#	100#	100#	*&	0.90	ms	0.25	$1/2^-$#	11	20Kh08	TD	1996	SF≈100;α ?	*
*^{245}Es	T : average 19Br06=1.08(10) 08Ga25=0.92(+0.20-0.14) 89Ha27=1.1(0.1)														**
*^{245}Es	T : 67Mi06=1.33(0.15)														**
*^{245}Es	D : %α average 19Br06=54(7) 73Es01=40(10); other 67Mi06=17(4)														**
*^{245}Es^p	E : 253.2 keV above ^{245}Es^m														**
*^{245}Md	T : average 20Kh08=0.33(+0.15-0.08) 96Ni09=0.35(+0.23-0.16)														**
*^{245}Md^m	T : from 96Ni09; other 20Kh08=0.9(+0.6-0.3)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{246}Pu	65395	15				10.84 d 0.02	0^+	11			1955	β^-=100	
^{246}Am	64994#	18#				39 m 3	7^-	11			1955	β^-=100	*
^{246}Am^m	65024	15	30#	10#		25.0 m 0.2	$2(^-)$	11			1955	β^-≈100;IT ?	*
^{246}Am^n	66990#	800#	2000#	800#		73 μs 10		11			1972	SF≈100;IT ?	
^{246}Cm	62616.9	1.5				4.706 ky 0.040	0^+	11			1954	α=99.97385 7; SF=0.02615 7	
^{246}Cm^m	63796.6	1.5	1179.66	0.13		1.12 s 0.24	8^-	11	19Sh34	ETJ	2012	IT=100	
^{246}Bk	63970	60				1.80 d 0.02	$2(^-)$	11			1954	β^+≈100;α ?	
^{246}Cf	64090.2	1.5				35.7 h 0.5	0^+	11			1951	α=100;SF=2.4e-4 4;ε ?	
^{246}Es	67820	90				7.5 m 0.5	4^-#	11			1954	β^+=90.1 18;α=9.9 18; β^+SF≈0.003	
^{246}Es^p	68010	100	190	50			2^-#		08An16	E			*
^{246}Es^q	68200	90	379.5	2.0					19Vo03	E			
^{246}Fm	70191	14				1.54 s 0.04	0^+	11	11Ve03	TD	1966	α=93.2 6;SF=6.8 6;ε<1.3	*
^{246}Md	76120#	260#			*	0.92 s 0.18	1^-#	11	10An08	TD	1996	α=100	*
^{246}Md^m	76170#	260#	60	60	AD*	4.4 s 0.8	4^-#	11	10An08	TD	2010	α=57 3;β^+>77;β^+SF>10; α<23	
*^{246}Am	J : direct β^- feeding to ^{246}Cm^m (K=8-)												**
*^{246}Am^m	D : other %IT<0.02 in Ensdf2011, based on the observation of 6+ to 4+												**
*^{246}Am^m	D : gamma in ^{246}Cm, is not trusted by Nubase												**
*^{246}Es^p	E : other 19Vo03=151.9(2.0) keV												**
*^{246}Fm	D : %SF others 67Nu01=4.5(1.3) 96Ni09=15(5)												**
*^{246}Md	T : average 10An08=0.9(0.2) 96Ni09=1.0(0.4)												**
^{247}Pu	69210#	200#				2.27 d 0.23	$1/2^+$#	15			1983	β^-=100	
^{247}Am	67150#	100#				23.0 m 1.3	5/2#	15			1967	β^-=100	
^{247}Cm	65533	4				15.6 My 0.5	$9/2^-$*	15			1954	α=100	
^{247}Cm^m	65760	4	227.38	0.19		26.3 μs 0.3	$5/2^+$	15			1968	IT=100	
^{247}Cm^n	65938	4	404.90	0.03		100.6 ns 0.6	$1/2^+$	15			2003	IT=100	
^{247}Bk	65490	5				1.38 ky 0.25	$3/2^-$	15			1965	α≈100;SF ?	
^{247}Cf	66109	14				3.11 h 0.03	$(7/2^+)$	15			1954	ε=99.965 5;α=0.035 5	
^{247}Es	68578	19			*	4.55 m 0.26	$(7/2^+)$	15	89Ha27	J	1967	β^+≈93;α≈7;SF ?	
^{247}Es^m	68630#	50#	50#	50#	*	> 20# μs	$(3/2^-)$					IT ?;β^+ ?;α ?	
^{247}Fm	71670#	180#				31 s 1	$(7/2^+)$	15			1967	α≈64;β^+ ?	
^{247}Fm^m	71720#	180#	49	8	AD	5.1 s 0.2	$(1/2^+)$	15			1967	α=88 2;β^+ ?;IT ?	*
^{247}Md	75940#	210#				1.19 s 0.09	$7/2^-$#	15	10An08	TJD	1981	α≈100;SF<0.1	*
^{247}Md^m	76200#	210#	260	40	AD	250 ms 40	$1/2^-$#	15	10An08	TJD	1993	α=79 5;SF=21 5	
*^{247}Fm^m	D : %IT from 06He27=12(2), but no direct gamma-ray decay was observed												**
*^{247}Md	T : average 10An08=1.2(0.1) 93Ho.A=1.12(0.22)												**
^{248}Am	70560#	200#				3# m	3^+#	14				β^- ?	
^{248}Cm	67392.7	2.4				348 ky 6	0^+	14			1956	α=91.61 16;SF=8.39 16; 2β^- ?	
^{248}Cm^m	68850.8	2.6	1458.1	1.0		146 μs 18	8^-#		19Sh34	ETJ	2012	IT=100	
^{248}Bk	68130	50			*	> 9 y	6^+#	14			1956	α ?;ε ?	
^{248}Bk^m	68108	21	−20	50	*	23.7 h 0.2	$1(^-)$	14			1956	β^-=70 5;ε=30 5;α ?	
^{248}Bk^p	68180#	70#	50#	50#			(5^-)						
^{248}Cf	67238	5				333.5 d 2.8	0^+	14			1954	α≈100;SF=0.0029 3	
^{248}Es	70300#	50#				24 m 3	2^-#	14			1956	β^+≈100;α≈0.25; β^+SF=3.5e-4 18	*
^{248}Fm	71898	8				34.5 s 1.2	0^+	14			1958	α≈100;β^+ ?;SF=0.10 5	
^{248}Fm^m	73100#	100#	1200#	100#		10.1 ms 0.6	6^+#	14			2010	IT ?;α ?;β^+ ?	
^{248}Md	76950#	180#				7 s 3		14			1973	β^+=80 10;α=20 10; β^+SF<0.05	
^{248}No	80690#	220#				<2us	0^+	14	03Be18	I	2003	SF ?	
*^{248}Es	D : %β^+SF from 01Sh09; other 80Ga07=3e-5%												**
^{249}Am	73100#	300#				3# m	5/2#					β^- ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{249}Cm	70750.7	2.4				64.15 m 0.03	$1/2^+$	11			1956	β^-=100	
^{249}Cm^m	70799.5	2.4	48.76	0.04		23 μs	$7/2^+$	11			1966	α=100	
^{249}Bk	69846.3	1.2				327.2 d 0.3	$7/2^+*$	11	14Ch47	T	1954	$\beta^-\approx$100;α=0.00145 8; SF=47e-9 2	
^{249}Bk^m	69855.1	1.2	8.777	0.014		300 μs	$3/2^-$	11	60As06	T	1960	IT=100	
^{249}Cf	69722.7	1.2				351 y 2	$9/2^-$	11			1954	α=100;SF=5.0e-7 4	
^{249}Cf^m	69867.7	1.2	144.98	0.05		45 μs 5	$5/2^+$	11			1967	IT=100	
^{249}Es	71180#	30#				102.2 m 0.6	$7/2^+$	11			1956	$\beta^+\approx$100;α=0.57 8	
^{249}Fm	73519	6				1.6 m 0.1	$7/2^+$	11	11Lo06	J	1960	β^+ ?;α=33 9	*
^{249}Md	77180	160			*	25.6 s 0.9	$(7/2^-)$	11	19Br06	TD	1973	α=75 5;β^+ ?	*
^{249}Md^m	77280#	190#	100#	100#	*	1.9 s 0.9	$(1/2^-)$	11	01He35	TJD	2001	α=100	*
^{249}No	81790#	280#				57 μs 12	$5/2^+$#	11	03Be18	T	2003	β^+ ?;α ?	*

*^{249}Fm T : from 04He28; others 66Ak01=2.6(0.7) 59Pe27=2.5(1.0) **
*^{249}Md T : average 19Br06=26(1) 09He20=23(3) 73Es01=24(4) **
*^{249}Md^m T : symmetrized from 01He35=1.5(+1.2-0.5) **
*^{249}No T : symmetrized from 03Be18=54.0(+13.9-9.2) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{250}Cm	72990	10				8300# y	0^+	01			1966	SF$\approx$74;α ?;β^- ?	
^{250}Bk	72952.0	2.9				3.212 h 0.005	2^-	01			1954	β^-=100	
^{250}Bk^m	72987.6	2.9	35.59	0.10		29 μs 1	4^+	01	08Ah02	EJ	1966	IT=100	
^{250}Bk^n	73038	3	85.6	1.6		213 μs 8	7^+	01	08Ah02	J	1972	IT=100	*
^{250}Bk^p	73163.8	2.9	211.80	0.20			2^+	01	08Ah02	EJ		IT=100	
^{250}Cf	71170.3	1.5				13.08 y 0.09	0^+	01			1954	α=99.923 3;SF=0.077 3	
^{250}Es	73230#	100#			*	8.6 h 0.1	$6(^+)$	01			1956	$\beta^+\approx$100;α ?	
^{250}Es^m	73430#	180#	200#	150#	*	2.22 h 0.05	$1(^-)$	01			1970	$\beta^+\approx$100;α ?	
^{250}Fm	74072	8				31.0 m 1.1	0^+	01	18Mi11	T	1954	$\alpha\approx$100;SF=0.0069 10;ε ?	*
^{250}Fm^m	75271	8	1199.2	1.0		1.92 s 0.05	(8^-)	01	08Gr17	ETJ	1973	IT$\approx$100;α ?;β^+ ?;SF ?	*
^{250}Md	78400	90				54 s 4	2^-#	01	08An16	TD	1973	β^+=93.0 8;α=7.0 8; β^+SF=0.026 15	*
^{250}Md^m	78520	90	120	40	AD	42.4 s 4.5	7^+#		19Vo03	TI	2019	α= ?;β^+ ?;IT ?	
^{250}No	81570#	200#				5.08 μs 0.27	0^+	06	18Sv02	T	2003	SF$\approx$100;α ?;β^+ ?	*
^{250}No^m	82620#	280#	1050#	200#		36.3 μs 2.3	(6^+)	06	20Ka02	TD	2001	SF$\approx$100;IT=?;α ?	*

*^{250}Bk^n E : from a least-squares fit to gamma-ray data in 08Ah02 **
*^{250}Fm T : average 18Mi11=32.5(1.8) 08Ga25=28.4(+3.9-3.0) 06Ba09=30.4(1.5); **
*^{250}Fm T : others 06Fo02=18(+13-6) 66Ak01=30(3) **
*^{250}Fm^m T : others 07Gr17=1.93(0.15), superseded by 08Gr17, 73Gh03=1.8(0.1) **
*^{250}Md T : average 19Vo03=59.5(9.1) 08An16=50(+10-7) 73Es01=52(6); other **
*^{250}Md T : 08Ga25=25(+10-5) in conflict **
*^{250}Md D : %β^+SF symmetrized from 80Ga07=0.02(+0.02-0.01); other **
*^{250}Md D : %α 06Fo02=9(+19-7)% **
*^{250}No T : average 17Sv02,18Sv02=5.1(0.3) 06Pe17=3.7(+1.1-0.8) 03Be18=5.6(+0.9-0.7) **
*^{250}No^m T : average 20Ka02=34.4(+3.9-3.2) 18Sv02,17Sv02=36(3) 06Pe17=43(+22-15) **
*^{250}No^m T : 03Be18=46(+22-14) 01Og08=36(+11-6) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{251}Cm	76648	23				16.8 m 0.2	$(3/2^+)$	13			1978	β^-=100	*
^{251}Bk	75228	11				55.6 m 1.1	$(3/2^-)$	13			1967	β^-=100	
^{251}Bk^m	75264	11	35.5	1.3		58 μs 4	$(7/2^+)$	13			1966	IT=100	
^{251}Cf	74135	4				898 y 44	$1/2^+$	13			1954	$\alpha\approx$100;SF ?	
^{251}Cf^m	74505	4	370.47	0.03		1.3 μs 0.1	$11/2^-$	13			1971	IT=100	
^{251}Es	74512	5				33 h 1	$3/2^-$	13			1956	ε=99.5 2;α=0.5 2	
^{251}Es^m	74520	5	8.4	1.0		> 200# μs	$(7/2^+)$	13				IT ?;ε ?	
^{251}Fm	75959	14				5.30 h 0.08	$9/2^-$	13			1957	β^+=98.20 13;α=1.80 13	
^{251}Fm^m	76159	14	200.0	0.1		21.8 μs 0.8	$5/2^+$	13	18Re07	TJ	1970	IT=100	*
^{251}Md	78967	19				4.21 m 0.23	$(7/2^-)$	13	06Ch52	TD	1973	β^+ ?;α=10 1	*
^{251}Md^p	79020	18	53	8	AD	20# s	$(1/2^-)$	13			2006	α ?;IT ?	
^{251}No	82850#	180#				800 ms 10	$(7/2^+)$	13	06He27	J	1967	α=83 16;β^+ ?;SF<0.3	*
^{251}No^m	82960#	180#	106	6	IT	1.02 s 0.03	$(1/2^+)$	13			1997	α=100	
^{251}No^n	83980#	180#	1128.0	1.0		> 1.7 μs	$17/2^-$#	13	06He27	ITD	2006	IT ?	*
^{251}Lr	87830#	200#				300# μs						β^+ ?;α ?	

*^{251}Cm J : direct β^- feeding to ^{251}Bk gs (J=3/2-) and 269.1-keV level **
*^{251}Cm J : (J=5/2+); expected conf=n3/2[622] **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

$*^{251}$Fm^{m} T : average 18Re07=23.7(1.1) 11As03=21.1(1.9) 06He20=21(3) 71Di03=15.2(2.3) **
$*^{251}$Md T : average 06Ch52=4.27(0.26) 73Es01=4.0(0.5) **
$*^{251}$No D : %α symmetrized from 01He35=91(+9-22)% **
$*^{251}$No^{n} E : 142.4(0.5) + 203.1(0.5) + 782.5(0.6) keV gammas in a cascade to 7/2+ gs **
$*^{251}$No^{n} J : expected conf=n^{3}(1/2[631],7/2[624],9/2[734]),K=17/2- **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{252}Cm	79060#	300#				1#	m		0^{+}	06				β^{-} ?;α ?	
^{252}Bk	78540#	200#				1.8	m	0.5		06	92Kr.A	TD	1988	β^{-}=?;α ?	
^{252}Cf	76034.6	2.4				2.645	y	0.008	0^{+}	06	18Be29	D	1954	α=96.8972 27; SF=3.1028 27	
^{252}Es	77290	50				471.7	d	1.9	(4^{+})	06	FGK12a	J	1956	α=78 2;ε=22 2	*
^{252}Fm	76817	5				25.39	h	0.04	0^{+}	06			1956	$\alpha\approx$100;SF=0.0023 2;2β^{+} ?	
^{252}Md	80470	90				2.3	m	0.8	1^{+}#	06			1973	$\beta^{+}\approx$100;α ?	
^{252}Md^{p}	80550	80	80	120					*am*						
^{252}No	82871	9				2.467	s	0.016	0^{+}	06	11Ga19	T	1967	α=67.6 5;SF=31.3 4; β^{+}=1.1 3	*
^{252}No^{m}	84125	9	1254.1	1.6		109.1	ms	2.5	(8^{-})		11Lo06	T	2007	IT=100	*
^{252}Lr	88540#	190#				369	ms	75	7^{-}#	06	08Ne01	TD	2001	$\alpha\approx$98;SF$\approx$2;β^{+} ?	*
^{252}Lr^{p}	88710#	190#	170	30	AD										

$*^{252}$Es J : strong direct ε feeding to 3+ level at 969.8 keV in ^{252}Cf and the **
$*^{252}$Es J : expected p7/2[633]->n7/2[613] configuration change **
$*^{252}$No T : average 11Ga19=2.47(0.02) 06Le29=2.46(0.05) (α(t)) 2.54(0.07) **
$*^{252}$No T : (SF(t)) 12Su22=2.43(0.13) 01Og08=2.44(0.04); others 12Sv02=2.3(0.1) **
$*^{252}$No T : 04He28=2.52(0.22) 03Be18=2.38(+0.26-0.22) **
$*^{252}$No D : %SF average 01Og08=32.2(0.5)% 11Ga19=29.3(0.9)% 03Be18=32(3) **
$*^{252}$No D : 77Be09=26.9(1.9); %β^{+} and %α from β^{+}/α=0.016(0.005) in **
$*^{252}$No D : in 02He01; other α/SF=3.3(0.8) in 06Le29 in conflict **
$*^{252}$No^{m} E : from a least-squares fit to the gamma rays in 07Su19 **
$*^{252}$No^{m} T : average 11Lo06=110(8) 08Ro21=109(6) 12Su22=109(3), supersedes **
$*^{252}$No^{m} T : 07Su19=110(10) **
$*^{252}$Lr T : average 08Ne01=270(+180-80) 01He35=360(+110-70) **
$*^{252}$Lr D : %SF 76Og02$\sim$2% **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{253}Bk	80930#	360#				60#	m		$3/2^{-}$#	13	91Kr.A	I	1991	β^{-} ?	
^{253}Cf	79302	4				17.81	d	0.08	$(7/2^{+})$	13			1954	β^{-}=99.69 4;α=0.31 4	
^{253}Es	79010.5	1.2				20.47	d	0.03	$7/2^{+}*$	13	05Ah03	D	1954	α=100;SF=8.7e-6 3	*
^{253}Es^{m}	79117	4	106	4		> 10#	μs		$3/2^{-}$#	13	93Mo18	IJ		IT ?	
^{253}Fm	79345.5	1.5				3.00	d	0.12	$1/2^{+}$	13			1957	ε=88 1;α=12 1	*
^{253}Fm^{m}	79486	6	140	6		> 100#	ns		$7/2^{+}$#					IT ?	*
^{253}Fm^{n}	79697	6	351	6		560	ns	60	$11/2^{-}$#	13	11An13	ETJ	2011	IT=100	*
^{253}Md	81170#	30#				12	m	8	$(7/2^{-})$	13	05He27	D	1992	$\beta^{+}\approx$100;$\alpha\approx$0.7	*
^{253}Md^{p}	81230#	40#	60	30		1#	m		$1/2^{-}$#	13			1971	α ?;IT ?	
^{253}No	84359	7				1.57	m	0.02	$9/2^{-}*$	13	18Ra11	J	1967	α=55 3;β^{+} ?;SF ?	*
^{253}No^{m}	84527	7	167.5	0.5		30.3	μs	1.6	$5/2^{+}$	13	09He23	T	1973	α=100	*
^{253}No^{n}	85560	110	1196	107		706	μs	24	$19/2^{+}$#		11Lo06	TJ	2011	IT=100	*
^{253}No^{p}	85620	110	1256	113		552	μs	15	$25/2^{+}$#	13	11Lo06	JD	2011	IT=100	*
^{253}Lr	88520	160			*	632	ms	46	$(7/2^{-})$	13	01He35	TJD	1985	α=90 10;SF=1.0 6;β^{+} ?	*
^{253}Lr^{m}	88560#	190#	30#	100#	*	1.32	s	0.14	$(1/2^{-})$	13	09He20	TJD	1985	α=90 10;SF=12 3;β^{+} ?; IT ?	*
^{253}Rf	93640#	410#			*	13	ms	5	$(7/2)(^{+}\#)$	06	97He29	TJD	1997	SF$\approx$100;α ?	*
^{253}Rf^{m}	93840#	440#	200#	150#	*	52	μs	14	$(1/2)(^{+}\#)$	06	97He29	TJD	1995	SF$\approx$100;α ?	*

$*^{253}$Es D : %SF from α/SF=1.15(0.03)e7 in 65Me02 **
$*^{253}$Fm J : favored α decay to 416.6-keV level in ^{249}Cf (J=1/2+) **
$*^{253}$Fm^{m} E : from 130-150 keV in 11An13 **
$*^{253}$Fm^{n} E : 211 keV above ^{253}Fm^{m} **
$*^{253}$Md T : symmetrized from 92Ka08=6.4(+11.6-3.6) **
$*^{253}$No T : average 18Ac08=1.67(0.09) 17Mi01=1.7(0.2) 09He23=1.56(0.02) **
$*^{253}$No T : 09Qi04=1.57(+0.18-0.15) 67Mi03=95(10) 67Gh01=105(20) **
$*^{253}$No D : ε/e^{+}=0.45(0.03) in 11An13 **
$*^{253}$No^{m} T : average 09He23=28(3) 07Lo11=31.1(2.1) 73Be33=31.3(4.1); others **
$*^{253}$No^{m} T : 11An13=22.7(0.5) 10St14=24(2) outliers **

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	

*^{253}No^{n} E : greater than 1011 keV and less than 1380 keV **
*^{253}No^{n} T : 11Lo06=706(24); others: 07Lo11=970(210), 11An13=627(5) (r-ce-g(t)) **
*^{253}No^{n} T : 650(15) (r-ce-802,713,209g(t)) **
*^{253}No^{p} E : less than 120 keV above ^{253}No^{n} in 11Lo06t **
*^{253}No^{p} T : from 11An13 using (r-ce-K x rays(t)) **
*^{253}Lr T : average 09He20=670(60) 11An13=552(15) 01He35=570(+70-60) **
*^{253}Lr D : %SF from 17He08; other 01He35=1.3(+3.0-1.0)% **
*^{253}Lr^{m} T : 09He20 supersedes 01He35=1.49(+0.30-0.21); other 10He11=1.2(+0.7-0.4) **
*^{253}Lr^{m} D : %SF from 17He08; other 01He35=8(5)% **
*^{253}Rf T : symmetrized from 97He29=11(+6-3) **
*^{253}Rf^{m} T : symmetrized from 97He29=48(+17-10) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{254}Bk	84390#	300#				1#	m			19				β^- ?	
^{254}Cf	81341	11				60.5	d	0.2	0^+	19			1955	SF=99.69 2;α=0.31 2; 2β^- ?	
^{254}Es	81994.2	2.9				275.7	d	0.5	7^+	19			1954	$\alpha\approx$100;ε ?;β^-=1.74e-4 8; SF<3e-6	*
^{254}Es^{m}	82074.5	2.7	80.4	1.1	AD	39.3	h	0.2	2^+*	19	FGK207	E	1954	β^-=98 2;IT<3;α=0.32 1; ε=0.076 7;SF<0.045	*
^{254}Fm	80902.5	1.8				3.240	h	0.002	0^+	19			1954	α=99.9408 3;SF=0.0592 3	
^{254}Md	83450#	100#			*	10	m	3	0^-#	19			1970	$\beta^+\approx$100;α ?	
^{254}Md^{m}	83500#	140#	50#	100#	*	28	m	8	3^-#	19			1970	$\beta^+\approx$100;α ?	
^{254}No	84723	10				51.2	s	0.4	0^+	19			1966	α=90 1;β^+=10 1;SF=0.17 2	*
^{254}No^{m}	86019	10	1296.4	1.1		264.9	ms	1.4	(8^-)	19			1973	IT=100;SF=0.020 12; α<0.01	
^{254}No^{n}	87940#	300#	3217#	300#		184	μs	3	16^+#	19	10He10	EJT	2006	IT=100;SF$\leq$0.012	*
^{254}Lr	89650	90				12.0	s	0.9	4^+#	19	19Vo03	T	1981	α=71.7 19;β^+=28.3 19; SF<0.1	*
^{254}Lr^{m}	89750	90	107	23	AD	20.3	s	4.1	1^+#	19	19Vo03	TE	2019	α=?;β^+ ?;IT ?	
^{254}Rf	93200#	280#				22.9	μs	1.0	0^+	19	20Kh01	T	1997	SF$\approx$100;α<1.5	*
^{254}Rf^{m}	94500#	340#	1300#	200#		4.3	μs	0.7	8^-#	19	15Da12	JTD	2015	IT$\approx$100;SF<10	*
^{254}Rf^{n}	95200#	570#	2000#	500#		247	μs	73	16^+#	19	15Da12	JT	2015	IT$\approx$100;SF<40	

*^{254}Es J : favored α decay to ^{250}Bk^{n} (J=7+) **
*^{254}Es^{m} T : other 19De11=51.8(16.1), probably a mixture between gs and isomer decays **
*^{254}No T : other (recent) 18Mi11=54(4) **
*^{254}No^{m} T : average 11Lo06=259(17) 10Cl01=263(2) 10He10=275(7) 06He19=266(2) **
*^{254}No^{m} T : 06Ta19=266(10); other 73Gh03=280(40) **
*^{254}No^{n} E : 10He10=2917(3) + x keV; x=300#(300#); 10Cl01=2930(2), but their level **
*^{254}No^{n} E : scheme is disputed **
*^{254}Lr T : average 19Vo03=11.9(0.9)(GSI) 01Ga20=13.4(4.2)(IMP); others (not used) **
*^{254}Lr T : 08Ga25=17.8(+1.9-1.6)(LBNL) 08An16=18.4(1.8)(GSI) **
*^{254}Lr T : 89Mu09=10.0(+4.5-2.4)(GSI) 85He22=13(+3-2)(GSI) 06Fo02=22(+9-6)(LBNL), **
*^{254}Lr T : presumably affected by the longer-lived isomer **
*^{254}Lr D : other (not used) %α=60(+11-15) %β^+=40(+15-11) in 06Fo02 **
*^{254}Rf T : average 20Kh01=20(3) 15Da12=23.2(1.1) 97He29=23(3); other **
*^{254}Rf T : 08Dr05=29.6(+0.7-0.6) **
*^{254}Rf^{m} T : average 15Da12=4.7(1.1) 20Kh01=4(1) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{255}Cf	84810#	200#				85	m	18	$(7/2^+)$	13			1981	β^-=100;SF ?;α ?	
^{255}Es	84089	11				39.8	d	1.2	$(7/2^+)$	13			1954	β^-=92.0 4;α=8.0 4; SF=0.0041 2	
^{255}Fm	83800	4				20.07	h	0.07	$7/2^+$	13			1954	α=100;SF=2.4e-5 10	
^{255}Fm^{p}	84031	4	231.1	0.2					$9/2^+$	13			2013	IT=100	
^{255}Md	84842	6			*	27	m	2	$7/2^-$	13			1958	β^+=93 1;α=7 1;SF ?	*
^{255}Md^{p}	84850#	70#	10#	70#	*	2#	m		$1/2^-$#	13				α ?;IT ?	
^{255}No	86812	14				3.52	m	0.18	$(1/2^+)$	13	11As03	TJ	1967	β^+=70 5;α=30 5	
^{255}No^{m}	87020#	100#	210#	100#		1#	s		$11/2^-$#					IT ?;α ?	
^{255}No^{p}	86910#	70#	100#	70#	Nm	> 100	ns		$7/2^+$#					IT ?	
^{255}Lr	89947	18				31.1	s	1.1	$(1/2^-)$	13	06Ch52	TJ	1971	α=99.7 1;β^+=0.3 1;SF ?	
^{255}Lr^{m}	89988	19	41	8	AD	2.54	s	0.05	$(7/2^-)$	13	06Ch52	J	2006	IT ?;$\alpha\approx$40	
^{255}Lr^{n}	90743	22	796	12		< 1	μs		$(15/2^+)$	13			2009	IT$\approx$100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{255}Lr^{p}	91412	22	1465	12		1.78	ms	0.05	(25/2$^+$)	13			2008	IT$\approx$100;α<0.15	*
^{255}Rf	94330#	180#				1.63	s	0.05	(9/2$^-$)	13	15An05	D	1975	α=52.8 22;SF=47.2 22; β^+<6	*
^{255}Rf^{m}	94480#	180#	150	22	AD	43	μs	9	(5/2$^+$)		15An05	ETJ	2015	IT=100	*
^{255}Rf^{n}	95380#	200#	1050	87		16	μs	5	19/2$^+$#		20Mo11	TED	2020	IT=100	*
^{255}Rf^{p}	95630#	200#	1300	87		41	μs	10	25/2$^+$#		20Mo11	TED	2020	IT=100	*
^{255}Db	99600#	280#			*	54	ms		9/2$^+$#	13	17He08	TD	1976	SF$\approx$67;α ?	*
^{255}Db^{m}	99700#	300#	100#	100#	*	2.8	ms		1/2$^-$#		17He08	TD	1976	SF$\approx$100;α ?	

*^{255}Md J : favored α decay to 7/2- level at 461.5 keV in ^{251}Es **
*^{255}Lr^{n} E : 740.0 keV above 9/2+ level, which is <30 keV above ^{255}Lr^{m} **
*^{255}Lr^{p} E : 1408.6 keV above 9/2+, which is <30 keV above ^{255}Lr^{m} **
*^{255}Lr^{p} T : average 09Je02=1.70(0.03) 08An16=1.81(0.02) (Birge ratio=3.05); other **
*^{255}Lr^{p} T : 08Ha31=1.4(0.1) **
*^{255}Rf T : average 20Mo11=1.60(0.07) 06He27=1.68(0.09) 01He35=1.64(0.11); **
*^{255}Rf T : other 20Kh01=1.9(0.2) **
*^{255}Rf D : %SF average 20Mo11=51(7) 19Kh01=53(8) 15An05=45(3) 97He29=45(6) **
*^{255}Rf D : 97He29=52(6); %β^+ from 15An05 **
*^{255}Rf J : favored α decay to the (9/2-) level at 203.6 keV in ^{251}No **
*^{255}Rf^{m} T : other 20Kh01>30 us **
*^{255}Rf^{n} T : symmetrized from 20Mo11=15(+6-4) **
*^{255}Rf^{n} E : 900-1200 keV above the gs in 20Mo11 **
*^{255}Rf^{p} T : symmetrized from 20Mo11=38(+12-7) **
*^{255}Rf^{p} E : 1150-1450 keV above the gs in 20Mo11 **
*^{255}Db T : other 83OgZW=1.6(+0.6-0.4) **

^{256}Cf	87040#	310#				12.3	m	1.2	0$^+$	17			1980	SF=100;α ?;2β^- ?	
^{256}Es	87190#	100#			*&	7.6	h		7$^+$#	17			1976	$\beta^-\approx$100;β^-SF=0.002	
^{256}Es^{m}	87190#	140#	0#	100#	*&	25.4	m	1.2	0$^+$#	17	81Lo15	T	1981	β^-=100	*
^{256}Fm	85485	3				157.1	m	1.3	0$^+$	17			1955	SF=91.9 3;α=8.1 3	
^{256}Md	87460#	120#			*	77.7	m	1.8	(1$^-$)	17			1955	β^+=90.8 7;α=9.2 7;SF<3	
^{256}Md^{m}	87620	70	160#	100#	*	100#	m		7$^-$#					β^+ ?;α ?;SF ?	
^{256}Md^{p}	87700#	120#	240#	140#					*am*						
^{256}No	87823	8				2.91	s	0.05	0$^+$	17			1963	α=99.45 5;SF=0.55 5;ε ?	*
^{256}Lr	91750	80				27.9	s	1.0	(0$^-$,3$^-$)#	17			1965	α=85 10;β^+=15 10;SF<0.03	
^{256}Lr^{p}	91980#	90#	230#	40#						17					
^{256}Rf	94222	18				6.60	ms	0.05	0$^+$	17	20Mo11	T	1975	SF=99.69 10;α=0.31 10	*
^{256}Rf^{m}	95340#	100#	1120#	100#		25	μs	2	4$^-$#	17	15Ko14	J	2009	IT=100;SF ?	
^{256}Rf^{n}	95620#	100#	1400#	100#		17	μs	2	8$^-$#	17			2009	IT=100;SF ?	
^{256}Rf^{p}	96620#	200#	2400#	200#		27	μs	5		17			2009	IT=100;SF ?	*
^{256}Db	100300#	190#				1.7	s	0.4	9$^-$#	17	01He35	TD	2001	α=70 11;β^+=30 11;SF ?	*

*^{256}Es^{m} T : 81Lo15=25.4(2.4), but the uncertainty is 2 standard deviations **
*^{256}No D : %SF symmetrized from 90Ho03=0.53(+6-3) **
*^{256}Rf T : average 20Mo11=6.75(0.49) 20Ku23=6.90(0.23) 18Sv02=5.75(0.17) **
*^{256}Rf T : 13Ri07,12Gr12=6.9(0.2) 11Ro20=6.9(0.4) 10St14=5.1(1.0-0.7) **
*^{256}Rf T : 09Je01=6.67(0.09) 08Dr05=6.70(0.09) 97He29=6.2(0.2) 84Og02=6.7(0.2) **
*^{256}Rf D : %α average 20Ku23=0.29(+0.13-0.10) 97He29=0.32(0.017); other **
*^{256}Rf D : %SF 10St14=97(+2-6)% **
*^{256}Rf^{p} T : other 20Mo10=18(7) **
*^{256}Db T : symmetrized from 01He35=1.6(+0.5-0.3); other 83Og.A=2.6(+1.4-0.8) **

^{257}Es	89400#	410#				7.7	d	0.2	7/2$^+$#	13			1987	β^-=100;α ?	
^{257}Fm	88590	4				100.5	d	0.2	9/2$^+$	13	13As02	J	1964	α=99.790 4;SF=0.210 4	
^{257}Md	88992.5	1.6				5.52	h	0.05	(7/2$^-$)	13			1965	ε=85 3;α=15 3;SF ?	
^{257}No	90247	6				24.5	s	0.5	(3/2$^+$)	13	02Ho11	D	1967	α=85 8;β^+=15 8;SF ?	
^{257}No^{p}	90550#	120#	300#	120#					9/2$^+$#						
^{257}Lr	92670#	40#			*	6.0	s	0.4	7/2$^-$#	13	16He08	J	1971	$\alpha\approx$100;β^+ ?;SF ?	*
^{257}Lr^{m}	92770#	60#	100#	50#	*	0.27	s	0.12	1/2$^-$#		16He08	TI	2018	α ?; IT ?	*
^{257}Lr^{p}	92820#	110#	150#	100#					*am*	13					
^{257}Rf	95866	11				5.0	s	0.2	(1/2$^+$)	13	13Ri07	T	1969	α=89.3 14;β^+=9.4 14; SF=1.3 3	*
^{257}Rf^{m}	95940	10	73	11	AD	4.5	s	0.2	11/2$^-$#	13	10St14	TJ	1997	α=88.5 15;β^+=11.5 15;	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life	J^π	Ens	Reference	Year of discovery	Decay modes and intensities (%)	
											SF ?	
^{257}Rf^{n}	97022	10	1155	11	AD	106 μs 6	$21/2^+$#	13	13Ri07 TJ	2009	IT=100	*
^{257}Db	100150	160			*	2.3 s 0.2	$9/2^+$#	13	09He20 T	1985	α>94;SF<6;β^+ ?	*
^{257}Db^{m}	100290#	200#	140#	110#	*	670 ms 60	$(1/2^-)$	13	09He20 T	1985	α>87;SF<13;β^+ ?	*
*^{257}Lr	T : average 10St14=6.3(+0.9-0.7) and 5.8(0.5); others (not used)											**
*^{257}Lr	T : 97He29=3.3(+0.5-0.4), 4.3(+1.3-0.8) 76Be.A=0.646(0.025)											**
*^{257}Lr	T : 71Es01=0.6(0.1)											**
*^{257}Lr^{m}	J : direct β^+ decay feeding from ^{257}Rf (J=1/2+)											**
*^{257}Lr^{m}	T : symmetrized from 16He08=0.203(+0.164-0.063)											**
*^{257}Rf	J : favorite α decay to the (1/2+) level at 670 keV in ^{253}No											**
*^{257}Rf	T : average 13Ri07=6.1(0.5) 10St14=5.5(0.4) 10Be16=4.8(0.2) 09Qi04=4.7(0.3);											**
*^{257}Rf	T : others 85So03=3.8(0.8) 74Be.A=4.8(0.3) 71Gh03=4.8(0.5)											**
*^{257}Rf	D : %β^+ from 16He08, stated that 10St14=19.4(1.4) is a misprint; other											**
*^{257}Rf	D : 09Qi04=2(1)%											**
*^{257}Rf^{m}	E : other 97He29=118(4) keV from direct comparison of two alpha lines											**
*^{257}Rf^{m}	T : average 13Ri07=4.7(0.4) 10St14=4.9(0.7) 10Be16=4.6(0.3) 97He29=3.9(0.4)											**
*^{257}Rf^{m}	T : 08Dr05=4.1(+0.7-0.6) 09Qi04=4.1(+2.4-1.3)											**
*^{257}Rf^{m}	D : %β^+ from 16He08											**
*^{257}Rf^{n}	E : 1082(2) keV above ^{257}Rf^{m} in 10Be16											**
*^{257}Rf^{n}	T : others 10Be16=134.9 (7.7), reanalyzed in 13Ri07 to 10Be16=110(5)											**
*^{257}Rf^{n}	T : 20Mo10=105(19) 09Je01=109(13) (same group as 13Ri07)											**
*^{257}Rf^{n}	T : 09Qi04=160(+42-31)											**
*^{257}Db	T : from 09He20, supersedes 01He35=1.50(+0.19-0.15); 10He11=1.5(+0.9-0.4)											**
*^{257}Db^{m}	T : from 09He20, supersedes 01He35=760(+150-110); 10He11=360(+220-90)											**
*^{257}Db^{m}	J : favorite α decay to ^{253}Lr^{m} [J=(1/2-)]											**
^{258}Es	92700#	400#				4# m					β^- ?;α ?	
^{258}Fm	90430#	200#				370 μs 14	0^+	17	86Hu05 T	1971	SF≈100;α ?	
^{258}Md	91690	3			*	51.59 d 0.29	8^-#	17	93Mo18 D	1970	α≈100;β^+<0.0015; β^-<0.0015	*
^{258}Md^{m}	91690#	200#	0#	200#	*	57.0 m 0.9	1^-#	17	93Mo18 D	1980	ε=85 15;SF<15;β^- ?; α<1.2	*
^{258}No	91480#	100#				1.23 ms 0.12	0^+	17	18Br13 T	1989	SF≈100;α ?	*
^{258}Lr	94780#	100#				3.92 s 0.33		17	14Ha04 TD	1971	α=97.4 18;β^+=2.6 18	
^{258}Lr^{p}	95020#	140#	240#	100#			*am*					
^{258}Rf	96344	16				12.5 ms 0.5	0^+	17	20Mo11 T	1969	SF=95.1 16;α=4.9 16	*
^{258}Rf^{m}	97540#	300#	1200#	300#		3.4 ms 1.7		17	16He15 ITD	2016	IT= ?;α ?;β^+ ?	*
^{258}Rf^{n}	97840#	500#	1500#	500#		15 μs 10		17	16He15 ITD	2016	IT ?; SF ?	
^{258}Db	101510	90			&	2.17 s 0.36	0^-#	17	19Vo03 TJ	1985	α=64 10;β^+=36 10	*
^{258}Db^{m}	101560	90	53	14	AD &	4.41 s 0.21	5^+#	17	19Vo03 TEJ	1981	α=77 8;β^+=23 8;SF ?	*
^{258}Sg	105300#	410#				2.7 ms 0.5	0^+	17	17He08 TD	1997	SF≈100;α ?	*
*^{258}Md	D : derived from: "the sum of SF, ε and β^- decay branches < 0.003%" in											**
*^{258}Md	D : 93Mo18 and T(SF)>150000 y, from 86Lo16, thus %SF<1e-4%											**
*^{258}Md^{m}	D : %SF<15 derived from 93Mo18 "the sum of SF and β^- decay branches < 30%"											**
*^{258}No	T : average 18Br13=1.24(+0.16-0.14) 89Hu09=1.2(0.2)											**
*^{258}Rf	T : average 20Mo11=8.79(1.12) 19He17=14.2(+1.2-0.4) 16He15=10.0(1.1)											**
*^{258}Rf	T : 08Ga08=14.7(+1.2-1.0) 85So03=13(3) 69Gh01=11(2); other											**
*^{258}Rf	T : 20Ku23=12(+16-10)											**
*^{258}Rf^{m}	T: symmetrized from 16He15=2.4(+2.4/-0.8)											**
*^{258}Db	T : others 16He15=3.6(0.3), 2.8(0.6) 09He20=1.9(0.5)											**
*^{258}Db	D : from 09He20											**
*^{258}Db^{m}	T : others 16He15=4.4(1.0) 09He20=4.3(0.5) 06Fo02=4.8(+1.0-0.8)											**
*^{258}Db^{m}	T : 01Ga20=4.3(1.1) 85He22=4.4(+0.9-0.6)											**
*^{258}Db^{m}	D : from 09He20; others %β^+ 06Fo02=39(+11-9) 85He22=33(+9-5)											**
*^{258}Sg	T : symmetrized from 17He08=2.6(+0.6-0.4), determined by combining data											**
*^{258}Sg	T : from 09Fo02, 02Pa.A and 97He29											**
^{259}Fm	93700#	280#				1.5 s 0.2		13		1980	SF=100	
^{259}Md	93560#	100#				1.60 h 0.06	$7/2^-$#	13		1982	SF≈100;α ?	
^{259}No	94079	6				58 m 5	$9/2^+$	13	13As02 J	1973	α=75 4;ε=25 4;SF<10	
^{259}No^{p}	94310#	150#	230#	150#								

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{259}Lr	95850#	70#				6.2	s	0.3	$1/2^-$#	13			1971	α=78 2;SF=22 2;β^+ ?	
^{259}Lr^{p}	96200#	170#	350#	150#											
^{259}Rf	98370#	70#				2.63	s	0.26	$3/2^+$#	13	08Ga08	T	1969	α=85 4;β^+=15 4;SF<3	*
^{259}Rf^{p}	98430#	100#	60	70	Nm				$(7/2^+)$						
^{259}Rf^{q}	98570#	110#	210	90	Nm				$(9/2^+)$						
^{259}Db	101990	60				510	ms	160	$9/2^+$#	13	01Ga20	D	2001	α=100	
^{259}Sg	106520#	180#				402	ms	56	$(11/2^-)$	13	15An05	TJD	1985	$\alpha\approx$100;SF ?;β^+ ?	
^{259}Sg^{m}	106610#	180#	87	22	AD	226	ms	27	$(1/2^+)$		15An05	TJD	2015	$\alpha\approx$97 1;SF$\approx$3 1;β^+ ?	
$*^{259}$Rf	T : average 08Ga08=2.5(+0.4-0.3) 94Gr08=1.7(+0.8-0.5);														**
$*^{259}$Rf	T : others 06Gr24=1.9(+1.3-0.5) 04Fo08=2.2(+1.7-0.8) 03Gi05=4.0(+7.3-1.6)														**
$*^{259}$Rf	T : 98Ho13=2.6(+1.4-0.7) 85So03=3.4(1.7) 81Be03=3.0(1.3)														**
$*^{259}$Rf	T : 73Dr10=3.2(0.8) 69Gh01=3.2(0.8); 10Ni14(1 event)=107 ms														**
$*^{259}$Rf	I : 08Ga08 suggest existence of an isomer formed only in direct production														**
$*^{259}$Rf	D : %β^+ 08Ga08=15(4)% to ^{259}Lr followed by SF; %SF 17He08<3%														**
^{260}Fm	95770#	440#			EU	1#	m		0^+					SF ?	*
^{260}Md	96550#	320#				27.8	d	0.8		99	92Lo.B	TD	1989	SF$\approx$100;α<5;ε<5;β^-<3.5	*
^{260}No	95610#	200#				106	ms	8	0^+	99			1985	SF=100	*
^{260}Lr	98280#	130#				3.0	m	0.5		99			1971	α=80 20;β^+=20 20	
^{260}Rf	99150#	200#				21	ms	1	0^+	99	85So03	T	1985	SF$\approx$100;α ?;β^+ ?	*
^{260}Db	103670#	90#				1.52	s	0.13		99	77Be36	TD	1970	α=90.4 6;SF=9.6 6;β^+ ?	*
^{260}Db^{p}	103770#	180#	100#	150#											
^{260}Sg	106547	21				4.95	ms	0.33	0^+	99	09He20	TD	1984	SF=71 3;α=29 3	*
^{260}Bh	113120#	200#				41	ms	14		16	08Ne01	TD	2008	$\alpha\approx$100;β^+ ?;SF ?	*
$*^{260}$Fm	I : T1/2$\sim$4 ms and %SF=100 mode were reported in the 92Lo.B, but the														**
$*^{260}$Fm	I : results were not confirmed in the subsequent experiment by same														**
$*^{260}$Fm	I : group (97Lo.A)														**
$*^{260}$Md	T : from 92Lo.B supersedes 86Hu01=31.8(0.5), same group														**
$*^{260}$No	T : other 19De11=155(+212-57)														**
$*^{260}$Rf	T : others 08Ga08=22.2(+3.0-2.4) 08Go.A=21(+7.3,-4.3) 13Mu08=12(11)														**
$*^{260}$Db	T : others 04Mo26=1.5(+0.8-0.4) 04Ga29=0.89(+0.79-0.35) 70Gh02=1.6(0.3)														**
$*^{260}$Db	T : 71Dr01=1.4(+0.6)0.3)														**
$*^{260}$Sg	T : supersedes 85Mu11=3.6(+0.9-0.6)														**
$*^{260}$Sg	D : other 85Mu11 %SF=50(+30-20)% and %α=50(+20-30)%														**
$*^{260}$Bh	T : symmetrized from 08Ne01=35(+19-9)														**
^{261}Md	98580#	510#				40#	m		$7/2^-$#					α ?	
^{261}No	98460#	200#				3#	h							α ?	
^{261}Lr	99560#	200#				39	m	12	$1/2^-$#	99			1987	SF$\approx$100;α ?	
^{261}Rf	101320	70			*&	2.1	s	0.2	$3/2^+$#	15	11Ha13	TD	1970	SF=82 4;α=18 4	*
^{261}Rf^{m}	101390#	120#	70#	100#	*&	74	s	5	$11/2^-$#	15	13Mu08	T	1970	$\alpha\approx$100;β^+ ?;SF ?	*
^{261}Rf^{p}	101550#	120#	230#	100#											
^{261}Db	104310#	110#				4.7	s	1.0	$9/2^+$#	99	13Su04	TD	1970	SF=73 11;α=27 11	*
^{261}Db^{p}	104590#	230#	280#	200#											
^{261}Sg	108005	18				183	ms	5	$(3/2^+)$	99	10St14	TJD	1984	α=98.1 4;β^+=1.3 3; SF=0.6 2	*
^{261}Sg^{m}	108110#	50#	100#	50#		9.3	μs	1.8	$7/2^+$#	99	10Be16	T	2010	IT=100	*
^{261}Bh	113080	180				12.8	ms	3.2	$(5/2^-)$	99	10He11	TJD	1989	$\alpha\approx$100;SF ?	*
$*^{261}$Rf	T : average 12Ha05=2.6(+0.7-0.5) 11Ha13=1.9(0.4) (α(t)) and														**
$*^{261}$Rf	T : 1.8(0.4) (SF(t)) 08Go.A=2.2(+0.9-0.5) 08Dv02=3(1) 96La11=2.1(0.2);														**
$*^{261}$Rf	T : others 02Ho11=4.2(+3.4-1.3), 13Mu08=3.9(3.0) 15Mo25=4.7(+3.6-1.4)														**
$*^{261}$Rf	T : 08Mo09=2 events at 2.97 and 8.3s 94La22=1.2(+1.0-0.5) originally														**
$*^{261}$Rf	T : attributed to ^{262}Rf, but re-assigned in 08Go.A and 11Ha13 to														**
$*^{261}$Rf	T : ^{261}Rf														**
$*^{261}$Rf	D : %SF average 11Ha13=73(6) 12Ha05=82(9) 13Mu08=88(5); other 08Dv02=91														**
$*^{261}$Rf^{m}	T : average 02Ho11=78(+11-6) 00Sy01=74(+7-6) 71Gh01=65(10); others														**
$*^{261}$Rf^{m}	T : 13Mu08=19(+5-3) 12Ha05=59(42) 08Dv02=20(+110-10) 08Ga08=71(+342-33)														**
$*^{261}$Db	T : average 13Su04=4.7(+3.6-1.4) 10St14=4.1(+1.4-0.8); others														**
$*^{261}$Db	T : 04Ga29=1.70(+0.79-0.49) 71Fl02=1.8(0.6) 71Gh01=1.8(0.6)														**
$*^{261}$Db	D : from 13Su04 where 11 SF and 4 α events were observed;														**
$*^{261}$Db	D : uncertainty estimated by Nubase														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

*^{261}Sg	T : average 10St14=184(5), supersedes 09He20=195(15), 10Be16=178(14)	**
*^{261}Sg^{m}	T : symmetrized from 10Be16=9.0(+2.0-1.5)	**
*^{261}Bh	T : symmetrized from 10He11=11.8(+3.9-2.4); others 06Fo02=10(+14-5)	**
*^{261}Bh	T : 08Ne08=6.7(+3.8-1.8) 89Mu09=11.8(+5.3-2.8), superseded by 10He11	**
*^{261}Bh	D : no SF decays were observed in 10He11 (%SF<5)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{262}Md	101670#	450#				3# m							SF ?;α ?	
^{262}No	100100#	360#				~5 ms		0^{+}	01			1988	SF=100;α ?	
^{262}Lr	102110#	200#				~4 h			01			1987	β^{+}=?;SF<10;α ?	
^{262}Rf	102390#	220#				250 ms	100	0^{+}	01	08Go.A	TD	1985	SF≈100	*
^{262}Rf^{m}	103390#	460#	1000#	400#		47 ms	5	$(8^{-},9^{-})$#		85So03	TD	1978	SF=100	*
^{262}Db	106250#	140#				34 s	4		01	14Ha04	TD	1971	SF=52 4;α=48 4;β^{+} ?	*
^{262}Db^{p}	106300#	160#	50#	70#									α ?	
^{262}Sg	108369	22				10.3 ms	1.7	0^{+}	01	17He08	D	2001	SF=94 6;α ?	*
^{262}Sg^{p}	109230	110	860	110	AD			9^{-}#						*
^{262}Bh	114250	90				84 ms	11		01	09He20	T	1981	α≈100;SF<20	*
^{262}Bh^{m}	114470	110	220	70	AD	9.5 ms	1.6		01	06Fo02	T	1981	α≈100;SF ?	*

*^{262}Rf	T : symmetrized from 08Go.A=210(+128-58), 7 SF events; others 85So03=1.3(1)	**
*^{262}Rf	T : 96La11=2.1(0.2) 94La22=1.2(+1.0-0.5) 98Tu01=2.5(+2.4-1.6). 11Ha13 and	**
*^{262}Rf	T : 08Go.A suggested that the long-lived activities belong to ^{261}Rf	**
*^{262}Rf^{m}	I : assigned as a K isomer in 96La11	**
*^{262}Db	T : symmetrized from 14Ha04=33.8(+4.4-3.5); other 15Mo25=39(+53-14)	**
*^{262}Sg	T : average 06Gr24=15(+5-3) 17He08=8.5(+2.3-1.5), determined by merging	**
*^{262}Sg	T : data from 01Ho06 and 12Ac04	**
*^{262}Sg^{p}	J : favored α decay from ^{266}Hs^{m} (J=9-#)	**
*^{262}Bh	T : average 09He20=83(14), supersedes 89Mu09=102(26) 06Fo02=84(+21-16);	**
*^{262}Bh	T : other 08Ne08=120(+55-29)	**
*^{262}Bh^{m}	T : average 06Fo02=9.6(+3.6-2.4) 97Ho14(11 events)=12.2(+5.5-2.8)	**
*^{262}Bh^{m}	T : 89Mu09=8.0(2.1); others 09He20=22(4) 08Ne08(4 events)=16(+14-5)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{263}No	103130#	490#				20# m							α ?;SF ?	
^{263}Lr	103670#	220#				5# h		$1/2^{-}$#					α ?	
^{263}Rf	104760#	150#				11 m	3		99	03Kr20	TD	2003	SF≈100;α ?	*
^{263}Rf^{p}	105060#	250#	300#	200#										
^{263}Db	107110#	170#				29 s	9	$9/2^{+}$#	99	92Kr01	DT	1992	SF=56 14;α=37 14; β^{+}=6.9 16	*
^{263}Db^{p}	107370#	260#	260#	200#										
^{263}Sg	110200#	100#			*	940 ms	140	$3/2^{+}$#	99	06Gr24	TD	1974	α=87 8;SF=13 8	*
^{263}Sg^{m}	110250#	100#	51	19	Nm*	420 ms	100	$7/2^{+}$#	99	04Fo08	T	1995	α≈100;SF ?;IT ?	*
^{263}Sg^{p}	110290#	100#	100	30	AD									
^{263}Bh	114500#	310#				200# ms		$5/2^{-}$#	99				α ?	
^{263}Hs	119680#	200#				0.9 ms	0.4	$3/2^{+}$#	99	09Dr02	TD	2009	α≈100;SF ?	*
^{263}Hs^{m}	120000#	200#	330	110	AD	1# ms		$11/2^{-}$#					α≈100;SF ?	

*^{263}Rf	T : average 03Kr20=24(+19-7)m 93Gr.C=500(+300-200)s 92Cz.A=600(+300-200)s;	**
*^{263}Rf	T : other 08Dv02=8(+40-4) s using one SF event	**
*^{263}Db	D : %SF symmetrized from 92Kr01=57(+13-15)%; %β^{+} average 03Kr20=3(+4-1)%	**
*^{263}Db	D : 93Gr.C=8(2)%	**
*^{263}Db	T : symmetrized from 92Kr01=27(+10-7); other 98Ik02=54(+98-21) from SF(t)	**
*^{263}Sg	T : average 06Gr24=820(+370-190) 94Gr08=553(+336-152) 74Gh04=900(200), all	**
*^{263}Sg	T : produced in direct reaction population	**
*^{263}Sg^{m}	T : average 04Fo08=290(+170-90) 04Mo40=549(+300-143) 03Gi05=222(+404-87)	**
*^{263}Sg^{m}	T : 98Ho13=310(+160-80), all produced via α decay of ^{267}Hs;	**
*^{263}Sg^{m}	T : other 10Ni14=τ=702 ms via α decay of ^{267}Hs	**
*^{263}Hs	T : symmetrized from 09Dr02=0.74(+0.48-0.21) 6 events observed	**
*^{263}Hs	D : no SF observed in 09Dr02 (%SF<8.4)	**

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life		J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{264}No	105010#	590#				1# m		0^{+}					α ?;SF ?	
^{264}Lr	106380#	440#				10# h							α ?;SF ?	
^{264}Rf	106080#	360#				1# h		0^{+}					α ?	
^{264}Db	109260#	240#				3# m							α ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{264}Sg	110780#	280#				78	ms	25	0^+	06	17He08	TD	2006	SF>80;α ?	*
^{264}Bh	115960#	180#				1.07	s	0.21		99	04Mo26	TD	1995	α≈86;SF≈14;β^+ ?	*
^{264}Bh^p	116290#	230#	330#	150#					*am*						
^{264}Hs	119563	29				0.7	s	0.3	0^+	99	17He08	TD	1986	α=70 30;SF=30 30	*
*^{264}Sg	T : symmetrized from 17He08=68(+32-16), determined by merging data from														**
*^{264}Sg	T : 10Ni14, 06Ni10 and 06Gr24														**
*^{264}Sg	D : no α observed in 17He08 (%α<36)														**
*^{264}Bh	T : average 04Mo26=0.9(+0.3-0.2) 04Ga29=1.17(+0.88-0.44)														**
*^{264}Bh	T : 02Ho11=1.02(+0.69-0.29)														**
*^{264}Hs	T : symmetrized from 17He08=0.63(+0.34-0.16), determined by merging data														**
*^{264}Hs	T : from 87Mu15 and 11Sa41														**
*^{264}Hs	D : %SF symmetrized from 17He08=20(+40-20), determined by merging data														**
*^{264}Hs	D : from 87Mu15 and 11Sa41														**
^{265}Lr	108230#	550#				10#	h		$1/2^-$#					α ?;SF ?	
^{265}Rf	108690#	360#				1.6	m	0.6	$9/2^+$#	15	16Ho09	TD	2010	SF≈100;α ?	*
^{265}Db	110380#	220#				15#	m		$9/2^+$#					α ?	
^{265}Sg	112790#	140#			*	9.2	s	1.6	$11/2^-$#	15	12Ha05	TD	1994	α>50;SF ?	*
^{265}Sg^m	112790#	130#	−10#	160#	*	16.4	s	2.4		15	12Ha05	TD	1994	α>50;SF ?	*
^{265}Bh	116400#	240#				1.19	s	0.52	$5/2^-$#	99	04Ga29	TD	2004	α=?	*
^{265}Hs	120900	24				1.96	ms	0.16	$3/2^+$#	99	09He20	T	1984	α≈100;SF ?	*
^{265}Hs^m	121130	24	229	22	AD	360	μs	150	$11/2^-$#	99	09He20	T	1995	α≈100;IT ?	*
^{265}Mt	126620#	440#				2#	ms							α ?	
*^{265}Rf	T : average 17Og01,15Ut02=1.0(+1.2-0.3) 16Ho09=61(+84-22)s; other														**
*^{265}Rf	T : 10El06=105(+503-48) s, one SF at 152 s														**
*^{265}Sg	T : average 12Ha05=8.5(+2.6,-1.6) 08Du09=8.9(+2.7-1.9)														**
*^{265}Sg^m	T : average 13Su04=20(+15-6) 12Ha05=14.4(+3.7,-2.5) 08Du09=16.2(+4.7-3.5);														**
*^{265}Sg^m	T : others 08Dv02=15(+7-4) 06Dv01=14.9(+9.1-4.1) 98Tu01=7.4(+3.3-2.7)														**
*^{265}Sg^m	T : 08Mo09 2 events at 23 and 80 s														**
*^{265}Bh	T : symmetrized from 04Ga29=0.94(+0.70-0.31)														**
*^{265}Hs	T : average 09He20=1.9(0.2) 99He11=2.0(+0.3-0.2)														**
*^{265}Hs^m	T : symmetrized from 09He20=300(+200-100); other 99He11=750(+170-120)														**
^{266}Lr	111660#	540#				22	h	14		19	19Kh04	TD	2014	SF=100	*
^{266}Rf	110140#	410#				4#	h		0^+					α ?;SF ?	
^{266}Db	112740#	280#				80	m	70		19	17Og01	T	2007	α ?;SF=?;β^+ ?	*
^{266}Sg	113620#	250#				390	ms	110	0^+	19	17He08	D	2006	SF>90	*
^{266}Bh	118100#	160#				10.6	s	2.2		19	20Ha27	T	2000	α≈100;β^+ ?;SF ?	*
^{266}Hs	121140	27				3.0	ms	0.6	0^+	19	12Ac04	TD	2001	α=76 9;SF=24 9	*
^{266}Hs^m	122240	90	1100	90	AD	280	ms	220	9^-#		12Ac04	T	2011	α≈100	*
^{266}Mt	127670	100				2.0	ms	0.5		19	09Ne02	T	1982	α≈100;SF ?	*
^{266}Mt^m	128810	120	1140	90	AD	6	ms	3			97Ho14	TD	1984	α=100	*
*^{266}Lr	T : symmetrized from 19Kh04,14Kh04=11(+21-5)														**
*^{266}Db	T : symmetrized from 17Og01,07Og02=22(+105-10), one event at 31.74 m														**
*^{266}Sg	T : average 13Og03=280(+190-80) 08Dv02=360(+250-100), supersedes														**
*^{266}Sg	T : 06Dv01=444(+444-148); others 98Tu01=21(+20-12) s 94La22=10-30 s														**
*^{266}Bh	T : symmetrized from 20Ha27=10.0(+2.6-1.7); others: 15Mo25=2.2(+2.9-0.8)														**
*^{266}Bh	T : 06Qi03=0.66(+0.59-0.26)														**
*^{266}Hs	T : average 11Ac.A=2.97(+0.78-0.51) 01Ho06=2.3(+1.3-0.6)														**
*^{266}Hs^m	T : symmetrized from 12Ac04=74(+354-34); the possibility in 01Ho06 that														**
*^{266}Hs^m	T : 01Ho06=6.3(+8.6-2.3) is ruled out by the 12Ac04 data														**
*^{266}Hs^m	J : from 15Ko14, expected conf=n^2(7/2[613],11/2[735])														**
*^{266}Mt	T : average 09Ne02=3.3(+2.5-1.0) 97Ho14=1.7(+0.6-0.4)														**
*^{266}Mt^m	T : symmetrized from 97Ho14=3.4(+4.7-1.3), 3 events at 7.8, 2.0 and 5.0 ms														**
^{267}Rf	113440#	580#				2.5	h	1.5		05	17Og01	TD	2004	SF=100	*
^{267}Rf^p	113520#	580#	80#	100#											
^{267}Db	114010#	370#				2.0	h	1.1	$9/2^+$#	05	17Og01	TD	2004	SF=100	*
^{267}Sg	115810#	260#				1.8	m	0.7			08Dv02	TD	2008	SF=83;α=17	*
^{267}Sg^p	115830#	270#	20#	50#											

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{267}Bh	118770#	260#				22	s	10	$5/2^-$#	05			2000	α=100	*
^{267}Hs	122660#	100#			*	55	ms	11		05	04Mo40	T	1995	α>80;SF ?	*
^{267}Hs^m	122700#	100#	39	24	AD*	990	μs	90		05	04Fo08	TD	2004	α=?;IT ?	*
^{267}Mt	127790#	500#				10#	ms							α ?	
^{267}Ds	133880#	200#				10	μs	8	$3/2^+$#	05	95Gh04	T	1995	α=100	*

*^{267}Rf T : symmetrized from 17Og01,06Og05=1.3(+2.3-0.5), supersedes 04Og12 one **
*^{267}Rf T : event at 2.3 h **
*^{267}Db T : symmetrized from 17Og01=1.3(+1.6-0.5) **
*^{267}Sg T : symmetrized from 08Dv02=80(+60-20) s; other 99Og.B=19 ms not trusted **
*^{267}Bh T : symmetrized from 00Wi15=17(+14-6); other 00Ei05=14(+9-4) **
*^{267}Hs T : symmetrized from 04Mo40=52(+13-8), combining the 04Mo40 (τ=77(+31-7)) **
*^{267}Hs T : and 98Ho13 (τ=72(+28-16)) data **
*^{267}Hs^m T : 04Fo08(2 events)=940(+120-45)us; other 04Mo40(1 event)=0.80(+3.8-0.37)s **
*^{267}Ds T : 95Gh04=2.8(+13.0-1.3), one event with τ=4 us **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{268}Rf	115480#	660#				1#	h		0^+					α ?;SF ?	
^{268}Db	117060#	530#				29	h	3		19	17Og01	T	2004	SF≈100;β^+ ?;α ?	*
^{268}Db^p	117210#	540#	150	80											
^{268}Sg	116800#	470#				2#	m		0^+					α ?;SF ?	
^{268}Bh	120710#	380#				190#	s							α ?;SF ?	
^{268}Hs	122970#	300#				1.4	s	1.1	0^+		10Ni14	TD	2010	α≈100	*
^{268}Mt	129150#	230#				23	ms	7		19	04Mo26	T	1995	α=100	*
^{268}Ds	133650#	300#				100#	μs		0^+					α ?	

*^{268}Db T : symmetrized from 17Og01=28.3(+3.3-2.6); others 16Fo10=28(3) **
*^{268}Db T : 13Ru11=26(+7-5) 13Og01=25.9(+6.2-4.2),supersedes 12Og02=27.9(+7.8-5.0) **
*^{268}Db T : 05Og02=29(+9-6) 04Og03=16(+19-6), 07St18=28(+11-4) **
*^{268}Hs T : symmetrized from 10Ni14=0.38(+1.8-0.17) **
*^{268}Mt T : symmetrized from 04Mo26=21(+8-5), 14 events; other 02Ho11=42(+29,-12), **
*^{268}Mt T : 6 events **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{269}Db	119150#	620#				3#	h		$9/2^+$#					α ?;SF ?	
^{269}Sg	119690#	370#				5	m	2		19	17Og01	T	2010	α≈100;SF ?	*
^{269}Bh	121480#	370#				1#	m		$5/2^-$#					α ?	
^{269}Hs	124490#	130#				15	s	7	$9/2^+$#	05	15Mo25	T	1996	α=100	*
^{269}Mt	129300#	310#				100#	ms							α ?	
^{269}Ds	134830	30				230	μs	110		05	95Ho03	T	1995	α=100	*

*^{269}Sg T : average 17Og01,15Ut02=3.1(+3.7-1.1)m 16Ho09=185(+254-68)s; other **
*^{269}Sg T : 10El06=128(+613-58) s, one alpha event at 185 s **
*^{269}Hs T : symmetrized from 15Mo25,13Su04=12(+9-4) **
*^{269}Ds T : symmetrized from 95Ho03=170(+160-60) **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{270}Db	122400#	580#				1.7	h	1.0		19	14Kh04	TD	2010	SF≈87;α≈13	*
^{270}Sg	121430#	460#				3#	m		0^+					α ?;SF ?	
^{270}Bh	124230#	300#				3.8	m	3.0		19	17Og01	TD	2007	α=100	*
^{270}Bh^p	124920#	360#	690#	200#											
^{270}Hs	125110#	250#				9	s	4	0^+	19	13Og03	TD	2003	α≈100;SF ?	*
^{270}Mt	130710#	190#				800	ms	400		19	15Mo25	TD	2004	α≈100	*
^{270}Ds	134680	40				205	μs	48	0^+	19	12Ac04	TD	2001	α≈100;SF ?	*
^{270}Ds^m	136070	60	1390	60	AD	4.3	ms	1.2	10^-#	19	12Ac04	T	2001	α≈70;IT≈30	*

*^{270}Db T : symmetrized from 14Kh04=1.0(+1.5-0.4), combines 14Kh04 and 13Og04 data; **
*^{270}Db T : other 19Kh04,14Kh04=1.0(+1.9-0.4) **
*^{270}Bh T : symmetrized from 17Og01=61(+292-28) **
*^{270}Hs T : symmetrized from 13Og03=7.6(+4.9-2.2); other 03Tu05=3.6(+0.8-1.4) **
*^{270}Mt T : symmetrized from 15Mo25=0.48(+0.66-0.18)s **
*^{270}Ds T : average 12Ac04=200(+70-40) 01Ho06=100(+140-40) **
*^{270}Ds^m T : symmetrized from 12Ac04=3.9(+1.5-0.8); other 01Ho06=6.0(+8.2-2.2) **
*^{270}Ds^m J : from 15Ko14, expected conf=n^2(9/2[615],11/2[725]),K=10- **

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^{π}	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{271}Sg	124620#	590#				2.2	m	1.1		06	17Og01	TD	2004	α=42 23;SF=58 23	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{271}Bh	125860#	380#				2.9	s	1.9		05	17Og01	TD	2013	α=100	*
^{271}Hs	127690#	280#				10#	s						2008	α ?;SF ?	
^{271}Mt	131100#	330#				400#	ms							α ?	
^{271}Ds	135950#	100#			*&	144	ms	53		05	16Ho09	TD	1998	SF=75;α=25	*
^{271}Ds^m	136020#	100#	68	27	AD*&	1.7	ms	0.4		05			1995	α=100	*
*^{271}Sg	T : symmetrized from 17Og01=1.6(+1.5-0.5)														**
*^{271}Bh	T : symmetrized from 17Og01=1.5(+2.8-0.6)														**
*^{271}Ds	T : average 16Ho09=96(+96-32) 04Mo40=86(+117-22)														**
*^{271}Ds^m	T : symmetrized from 04Mo40=1.63(+0.44-0.29), combining the 04Mo40														**
*^{271}Ds^m	T : (τ=2.9(+1.3-0.7)) and 98Ho13 (τ=1.8(+0.8-0.4)) data														**
^{272}Sg	126520#	690#				4#	m		0^+					α ?;SF ?	
^{272}Bh	128790#	530#				11.3	s	1.8		19	16Fo10	T	2004	α≈100	*
^{272}Hs	129000#	510#				10#	s		0^+					α ?;SF ?	
^{272}Mt	133480#	490#				400#	ms							α ?;SF ?	
^{272}Ds	136080#	420#				200#	ms		0^+					SF ?	
^{272}Rg	142770#	230#				4.2	ms	1.1		19	15Mo25	T	1995	α=100	*
*^{272}Bh	T : symmetrized from 16Fo10=10.5(+1.5-1.1); other 17Og01=10.6(+1.6-1.1),														**
*^{272}Bh	T : same raw data as 16Fo10														**
*^{272}Rg	T : symmetrized from 15Mo25=3.8(+1.4-0.8); other: 02Ho11=1.6(+1.1-0.5)														**
^{273}Sg	129920#	400#				5#	m							SF ?	
^{273}Bh	130680#	660#				1#	m							α ?;SF ?	
^{273}Hs	131770#	370#				1060	ms	500		15	17Og01	T	2010	α≈100; SF ?	*
^{273}Hs^p	131970#	390#	200#	100#										α ?;SF ?	
^{273}Mt	134780#	420#				800#	ms							α ?;SF ?	
^{273}Ds	138290#	140#				240	μs	100		05	15Mo25	T	1996	α≈100	*
^{273}Ds^m	138490#	140#	198	20	EU	120	ms			05			1996	α=100	
^{273}Rg	142890#	400#				2#	ms							α ?	
*^{273}Hs	T : symmetrized from 17Og01,15Ut02=760(+710-240); other 16Ho09=765(+765-255)														**
*^{273}Ds	T : symmetrized 15Mo25,13Su04=190(+140-60)														**
^{274}Bh	133760#	580#				57	s	27		19	17Og01	TD	2010	α=100	*
^{274}Hs	133410#	470#				500#	ms		0^+					α ?;SF ?	
^{274}Mt	137250#	380#				850	ms	540		19	17Og01	TD	2007	α=100	*
^{274}Ds	139200#	390#				10#	ms		0^+					α ?;SF ?	
^{274}Rg	144610#	210#				20	ms	11		05	15Mo25	TD	2004	α≈100	*
*^{274}Bh	T : symmetrized from 17Og01=44(+34-13) (recommended), based on														**
*^{274}Bh	T : 14Kh04=30(+54-12) 13Og04=54(+65-19)														**
*^{274}Mt	T : symmetrized from 17Og01=440(+810-170)ms, based on data from 07Og02														**
*^{274}Rg	T : symmetrized from τ=18(+24-7) in 15Mo25														**
^{275}Bh	135780#	600#				1#	m		$5/2^-$#					SF ?	
^{275}Hs	136490#	590#				280	ms	130		05	17Og01	TD	2004	α=100	*
^{275}Hs^p	136750#	600#	260#	100#											
^{275}Mt	138770#	390#				31	ms	17		05	17Og01	TD	2004	α=100	*
^{275}Ds	141670#	340#				10#	ms							α ?;SF ?	
^{275}Rg	145400#	450#				5#	ms							α ?	
*^{275}Hs	T : symemtrized 17Og01=200(+180-60); other 16Ho09=201(+201-67)														**
*^{275}Mt	T : symemtrized from 17Og01=20(+24-7)														**
^{276}Bh	138950#	600#				60#	s							α ?;SF ?	
^{276}Hs	138190#	720#				100#	ms		0^+					α ?;SF ?	
^{276}Mt	141310#	530#			*	700	ms	80		19	16Fo10	T	2004	α=100	*
^{276}Mt^m	141560#	540#	250	80	AD*	7	s	3		19	17Og01	TD	2012	α=100	*
^{276}Ds	142540#	550#				16#	ms		0^+					α ?;SF ?	
^{276}Rg	147390#	630#				10#	ms							α ?;SF ?	
^{276}Cn	150360#	500#				100#	μs		0^+					α ?;SF ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
$*^{276}$Mt	T : symmetrized from 16Fo10=690(+90-70); other 17Og01=520(100)														**
$*^{276}$Mt^m	T : symmetrized from 17Og01=4(+5-1)														**
^{277}Bh	141100#	600#				10#	s							α ?;SF ?	
^{277}Hs	141380#	450#			*	12	ms	9		14	16Ho09	TD	2010	SF≈100;α ?	*
^{277}Hs^m	141480#	460#	100#	100#	*	130	s	100		14	12Ho12	TD	2012	SF=100	*
^{277}Hs^p	142000#	490#	620#	200#											
^{277}Mt	143010#	660#				9	s	6		14	17Og01	TD	2013	SF=100;α ?	*
^{277}Ds	145090#	390#				6	ms	3		15	17Og01	T	2010	α≈100;SF ?	*
^{277}Rg	148410#	470#				4#	ms							α ?;SF ?	
^{277}Cn	152330#	150#				790	μs	330		05	15Mo25	TD	1996	α=100	*
$*^{277}$Hs	T : symmetrized from 16Ho09=3.1(+14.9-1.4) 10Du06=3.0(+14.4-1.4)														**
$*^{277}$Hs	T : 17Og01=3(+15-1); other 99Og10 one SF event at 16.5m, not trusted														**
$*^{277}$Hs^m	T : symmetrized from 12Ho12=34(+166-16) (SF 1 event)														**
$*^{277}$Mt	T : symmetrized from 17Og01,13Og04=5(+9-2)														**
$*^{277}$Ds	T : symmetrized from 17Og01,15Ut02=4.1(+3.7-1.3); other 16Ho09=4.1(+4.1-1.4)														**
$*^{277}$Cn	T : symmetrized from 15Mo25,13Su04=610(+460-180)														**
^{278}Bh	144370#	400#				2#	s			19	16Ho09	TD	2016	SF≈100;α ?	*
^{278}Hs	143220#	300#				2#	s		0^+	19	16Ho09	TD	2016	SF≈100;α ?	*
^{278}Mt	145770#	580#				6	s	3		19	17Og01	TD	2010	α=100	*
^{278}Mt^p	146160#	590#	390#	100#											
^{278}Ds	146250#	510#				270#	ms		0^+					α ?;SF ?	
^{278}Rg	150520#	390#				8	ms	5		19	17Og01	TD	2007	α=100	*
^{278}Cn	152840#	440#				2#	ms		0^+					α ?;SF ?	
^{278}Nh	159030#	220#				2.3	ms	1.3		19	15Mo25	TD	2004	α≈100	*
$*^{278}$Bh	T : 16Ho09=690(+3300,-310)s not trusted by evaluator, based on TNN														**
$*^{278}$Hs	T : 16Ho09=690(+3300,-310)s not trusted by evaluator, based on TNN														**
$*^{278}$Mt	T : symmetrized from 17Og01=4.5(+3.5-1.3) (recommended), based on data from														**
$*^{278}$Mt	T : 14Kh04=3.6(+6.5-1.4) 13Og04=5.2(+6.2-1.8)														**
$*^{278}$Rg	T : symmetrized from 17Og01,07Og02=4.2(+7.5-1.7)														**
$*^{278}$Nh	T : symmetrized from τ=2.0(+2.7-0.7) in 15Mo25,08Mo09														**
^{279}Hs	146500#	600#				1#	s							α ?;SF ?	
^{279}Mt	147590#	670#				20#	s							α ?;SF ?	
^{279}Ds	149020#	610#				210	ms	40		05	17Og01	TD	2004	SF=88 5;α=12 5	*
^{279}Ds^p	149250#	610#	230#	100#											
^{279}Rg	151720#	420#				170	ms	110		05	17Og01	TD	2004	α=100	*
^{279}Rg^p	151760#	430#	40#	100#											
^{279}Cn	155020#	400#				60#	μs							α ?;SF ?	
^{279}Nh	159460#	600#				1#	ms							α ?;SF ?	
$*^{279}$Ds	T : from 17Og01=210(40); other 16Ho09=290(+69-47)														**
$*^{279}$Ds	D : %SF symmetrized from 17Og01=89(+4-6)														**
$*^{279}$Rg	T : symmetrized from 17Og01=90(+170-40)														**
^{280}Hs	148420#	600#				100#	ms		0^+					α ?;SF ?	
^{280}Mt	150510#	600#				10#	s							α ?;SF ?	
^{280}Ds	150320#	750#				25	ms	20	0^+	19	17Ka66	TDI	1999	SF=100	*
^{280}Rg	153890#	530#				4.3	s	0.5		19	17Og01	T	2004	α=100	*
^{280}Cn	155650#	580#				5#	ms		0^+					α ?;SF ?	
^{280}Nh	161240#	400#				10#	ms							α ?;SF ?	
$*^{280}$Ds	I : the identification in 17Ka66 is tentative and it needs to be confirmed														**
$*^{280}$Ds	T : symmetrized from 17Ka66=6.7(+31.9-3); others 01Og01-3 events at 6.93 s,														**
$*^{280}$Ds	T : 14.3 s and 7.4 s yield 6.6(+9.0-2.4) s, but data were later reassigned														**
$*^{280}$Ds	T : to the ^{293}Lv chain														**
$*^{280}$Rg	T : symmetrized from 17Og01=4.2(+0.6,-0.4); other 16Fo10=4.4(+0.5-0.4)														**
^{281}Mt	152400#	600#				1#	s							α ?;SF ?	

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{281}Ds	153270#	490#			*	14	s	3		05	17Ka66	T	2004	SF=90 7;α=10 7	*
^{281}Ds^m	153350#	460#	80#	240#	*	0.9	s	0.7			12Ho12	TD	2012	α=100	*
^{281}Ds^p	153340#	500#	70#	100#											
^{281}Rg	155330#	770#				19	s	5		10	17Og01	TD	2010	SF=87 8;α=13 8	*
^{281}Cn	157950#	400#				180	ms	80		15	17Og01	T	2010	$\alpha\approx$100;SF ?	*
^{281}Nh	161810#	300#				100#	ms							α ?;SF ?	
*^{281}Ds	T : average 17Ka66=9.9(+13.6-3.6) 17Og01=12.7(+4.0-2.5);														**
*^{281}Ds	T : other 16Ho09=13.0(+4.5-2.7)														**
*^{281}Ds	D : %SF symmetrized from 17Og01=93(+5-9)														**
*^{281}Ds^m	T : symmetrized from 12Ho12=0.25(+1.18-0.11) s														**
*^{281}Rg	T : symmetrized from 17Og01=17(+6-3); other 16Fo16=21(+10-5)														**
*^{281}Rg	D : %SF symmetrized from 17Og01=88(+7-9)														**
*^{281}Cn	T : symmetrized from 17Og01,15Ut02=130(+120-40); other:														**
*^{281}Cn	T : 16Ho09=128(+128-43) (analyzing same data as 17Og01)														**
^{282}Mt	155460#	450#				100#	ms			19	16Ho09	TD	2016	$\alpha\approx$100; SF ?	*
^{282}Ds	154790#	300#				4.2	m	3.3	0^+	19	16Ho09	TD	2016	$\alpha\approx$100; SF ?	*
^{282}Rg	157740#	590#				130	s	50		19	17Og01	TD	2010	α=100	*
^{282}Cn	158830#	550#				1.1	ms	0.3	0^+	19	16Ho09	TD	2004	SF$\approx$100;α ?	*
^{282}Nh	163730#	400#				140	ms	90		19	17Og01	TD	2007	α=100	*
*^{282}Mt	T : 16Ho09=67(+320-30)s not trusted by evaluator, based on TNN														**
*^{282}Ds	T : symmetrized from 16Ho09=67(+320-30)s														**
*^{282}Rg	T : symmetrized from 17Og01=100(+70-30)														**
*^{282}Cn	T : symmetrized from 16Ho09=0.96(0.35-0.20); other: 17Og01=0.91(0.33-0.19)														**
*^{282}Nh	T : symmetrized from 17Og01,07Og02=73(+134-29)														**
^{283}Ds	157830#	500#				1#	m							α ?;SF ?	
^{283}Rg	159380#	680#				2#	m							α ?;SF ?	
^{283}Cn	161340#	620#				4.7	s	0.8		06	16Ho09	TD	2004	α=81;SF=19	*
^{283}Nh	164560#	440#				140	ms	90		05	17Og01	TD	2004	α=100	*
*^{283}Cn	T : symmetrized from 16Ho09=4.48(+0.98-0.68); other 17Og01=4.2(+1.1-0.7)														**
*^{283}Nh	T : symmetrized from 17Og01=75(+136-30)														**
^{284}Ds	159460#	500#				1#	m		0^+					α ?;SF ?	
^{284}Rg	161970#	500#				1#	m							α ?;SF ?	
^{284}Cn	162420#	760#				102	ms	17	0^+	19	17Og01	TD	2004	SF=100	*
^{284}Nh	166590#	530#				0.97	s	0.11		19	17Og01	TD	2004	α=100	*
^{284}Fl	168780#	660#				3.1	ms	1.3	0^+	19	17Og01	TD	2015	SF$\approx$100;α ?	*
*^{284}Cn	T : symmetrized from 17Og01=98(20-14); other 16Ho09=118(+24-17)														**
*^{284}Nh	T : symmetrized from 17Og01=0.97(0.12-0.10); other 16Fo10=0.97(0.12-0.10)														**
*^{284}Fl	T : symmetrized from 17Og01=2.5(+1.8-0.8); other 16Ho09=2.0(+2.7,-0.7)														**
^{285}Rg	163730#	600#				30#	s							α ?;SF ?	
^{285}Cn	165090#	510#			*	30	s	8		05	17Og01	TD	2004	α=100	*
^{285}Cn^m	165620#	460#	530#	270#	*	15	s	12			12Ho12	TD	2012	α=100	*
^{285}Nh	167770#	780#				4.6	s	1.1		10	17Og01	TD	2010	α=100	*
^{285}Fl	170930#	400#				210	ms	100		15	17Og01	T	2010	$\alpha\approx$100;SF<20	*
*^{285}Cn	T : symmetrized from 17Og01=28(+9-6); other 16Ho09=28.9(+10.1-5.9)														**
*^{285}Cn^m	T : symmetrized from 12Ho12=4.0(+19.1-1.8) s														**
*^{285}Nh	T : symmetrized from 07Og01=4.2(+1.4-0.8); other 16Fo16=2.9(+1.4-0.7),														**
*^{285}Nh	T : reanalyzed data of 13Og04=4.2(+1.4-0.8), 12Og06=4.9(+6.7-1.8),														**
*^{285}Nh	T : 10Og01=5.5(+5.0-1.8)														**
*^{285}Fl	T : symmetrized from 17Og01,15Ut02=150(+140-50); other: 16Ho09=152(+152-51),														**
*^{285}Fl	T : analyzed same data as 17Og01														**
^{286}Rg	166510#	460#				10#	s			19	16Ho09	TD	2016	$\alpha\approx$100;SF ?	*
^{286}Cn	166450#	700#				30	s	30	0^+	19	17Ka66	T	2016	$\alpha\approx$100;SF ?	*
^{286}Nh	169960#	590#				12	s	5		19	17Og01	TD	2010	α=100	*

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{286}Fl	171610#	550#				130	ms	30	0^+	19	17Og01	TD	2004	α=59 11;SF=41 11	*
*^{286}Rg	T : 16Ho09=640(+3100-300)s not trusted by evaluator, based on TNN														**
*^{286}Cn	T : symmetrized from 17Ka66=8.4(+40.5-3.9); other: 16Ho09=640(+3100-300)s														**
*^{286}Nh	T : symmetrized from 17Og01=9.5(+6.3-2.7) (recommended), based on data from														**
*^{286}Nh	T : 14Kh04=2.9(+5.5-1.1) 13Og04=13(+12-4)														**
*^{286}Fl	T : symmetrized from 17Og01=120(+40-20); other: 16Ho09=166(+40-27)														**
*^{286}Fl	D : %α symmetrized from 17Og01=60(+10-11); other: 16Ho09=52%														**
^{287}Cn	169370#	700#				30#	s							α ?;SF ?	
^{287}Nh	171460#	710#				20#	s							α ?;SF ?	
^{287}Fl	173930#	620#				510	ms	120		05	17Og01	T	2004	$\alpha\approx$100; SF ?	*
^{287}Mc	177750#	440#				60	ms	30		05	17Og01	TD	2004	α=100	*
*^{287}Fl	T : symmetrized from 17Og01=480(+140-90); other: 16Ho09=540(+170-100)														**
*^{287}Mc	T : symmetrized from 17Og01=37(+44-13)														**
^{288}Cn	170930#	700#				10#	s		0^+					α ?;SF ?	
^{288}Nh	173970#	700#				20#	s							α ?;SF ?	
^{288}Fl	174920#	760#				653	ms	113	0^+	19	16Ho09	TD	2004	$\alpha\approx$100; SF ?	*
^{288}Mc	179670#	540#				177	ms	20		19	17Og01	TD	2004	α=100	*
*^{288}Fl	T : average 16Ho09=644(+136-97) 17Ka66=274(+500-108);														**
*^{288}Fl	T : other: 17Og01=660(+140-100)														**
*^{288}Mc	T : symmetrized from 17Og01=174(+22-18); other 16Fo10=170(20)														**
^{289}Nh	175550#	500#				30#	s							α ?;SF ?	
^{289}Fl	177470#	510#				2.1	s	0.6		05	17Og01	TD	2004	$\alpha\approx$100;SF ?	*
^{289}Fl^m	178220#	470#	750#	280#		1.1	s	0.8			12Ho12	TD	2012	α=100	*
^{289}Mc	180680#	780#				410	ms	150		10	17Og01	T	2010	α=100	*
^{289}Lv	184460#	500#			RN	16#	ms			00	02Ni10	I		α ?	*
*^{289}Fl	T : symmetrized from 17Og01=1.9(+0.7-0.4); others 16Ho09=1.87(+0.65-0.38)														**
*^{289}Fl	T : 17Ka66=3.9(+5.3-1.4)														**
*^{289}Fl^m	T : symmetrized from 12Ho12=0.28(+1.35-0.13) s														**
*^{289}Mc	T : symmetrized from 17Og01=330(+120-80); other 16Fo16=270(+120-60),														**
*^{289}Mc	T : reanalyzed data of 13Og04=330(+120-80), 12Og06=430(+590-160),														**
*^{289}Mc	T : 10Og01=220(+260-80)														**
*^{289}Lv	T : 99Ni03=600(+860-300), α decay retracted by authors in 02Ni10														**
^{290}Nh	178320#	470#				8	s	6		19	16Ho09	TD	2016	$\alpha\approx$100; SF$\leq$50	*
^{290}Fl	178730#	700#				80	s	60	0^+	19	16Ho09	TD	2016	$\alpha\approx$100; SF ?;β^+<50	*
^{290}Mc	182790#	590#				840	ms	360		19	17Og01	T	2010	α=100	*
^{290}Lv	185030#	550#				9	ms	3	0^+	19	17Og01	T	2004	$\alpha\approx$100; SF ?	*
*^{290}Nh	T : symmetrized from 16Ho09=2.0(+9.6-0.9)														**
*^{290}Fl	T : symmetrized from 16Ho09=21(+101-10); other 16Ho09=19(+91-9) β^+ branch														**
*^{290}Mc	T : symmetrized from 17Og01=650(+490,-200) (recommended); based on data														**
*^{290}Mc	T : from 13Og04=240(+280-90) 14Kh04=1300(+2300-500)														**
*^{290}Lv	T : symmetrized from 17Og01=8.3(+3.5-1.9); other 16Ho09=8.3(+3.6-1.9)														**
^{291}Fl	181500#	700#				10#	s							α ?;SF ?	
^{291}Mc	184180#	740#				1#	s							α ?;SF ?	
^{291}Lv	187240#	620#				26	ms	12		05	17Og01	T	2004	$\alpha\approx$100;SF ?	*
^{291}Ts	191650#	600#				2#	ms							α ?;SF ?	
*^{291}Lv	T : symmetrized from 17Og01=19(+17-6); other 16Ho09=18(+25-7)														**
^{292}Mc	186600#	700#				5#	s							α ?;SF ?	
^{292}Lv	188130#	760#				16	ms	6	0^+	19	17Og01	T	2004	$\alpha\approx$100; SF ?	*
^{292}Ts	193620#	670#				10#	ms							α ?;SF ?	
*^{292}Lv	T : average 17Og01=13(+7-4) 17Ka66=11.9(+21.7-2.6);														**
*^{292}Lv	T : other 16Ho09=12.8(+7.0-3.3)														**

Table I. The NUBASE2020 table (Explanation of Table on page 030001-16)

Nuclide	Mass excess (keV)		Excitation Energy (keV)			Half-life			J^π	Ens	Reference		Year of discovery	Decay modes and intensities (%)	
^{293}Lv	190570#	520#				70	ms	30		05	17Og01	T	2004	α≈100; SF ?	*
^{293}Lv^m	191290#	470#	720#	290#		80	ms	60			12Ho12	TD	2012	α=100	*
^{293}Ts	194430#	780#				25	ms	6		10	17Og01	TD	2010	α=100	*
^{293}Og	198800#	710#			RN	1#	ms			00	02Ni10	I	2010	α ?	*
*^{293}Lv	T : symmetrized from 17Og01,15Og05=57(+43-17); others 16Ho09=57(+46-18)														**
*^{293}Lv	T : 17Ka66t=188(+342-74)														**
*^{293}Lv^m	T : symmetrized from 12Ho12=20(+96-9)														**
*^{293}Ts	T : symmetrized from 17Og01,15Og05=22(+8-4); other: 16Fo16=18(+8-4),														**
*^{293}Ts	T : reanalyzed data of 13Og04=22(+8-4), 12Og06=27(+12-6),														**
*^{293}Ts	T : 10Og01=14(+11-4)														**
*^{293}Og	T : 99Ni03=120(+180-60) α decay retracted by authors in 02Ni10														**
^{294}Ts	196400#	590#				70	ms	30		19	17Og01	TD	2010	α=100	*
^{294}Og	199320#	550#				0.7	ms	0.3	0^+	05	18Br13	T	2004	α≈100; SF ?	*
*^{294}Ts	T : symmetrized from 17Og01,15Og05=51(+38-16) (recommended); based on data														**
*^{294}Ts	T : from 14Kh04=51(+94-20) 13Og04=50(+60-18)														**
*^{294}Og	T : symmetrized from 18Br13=0.58(+0.44-0.18), supersedes														**
*^{294}Og	T : 17Og01=0.69(+0.64-0.22) 16Ho09=0.69(+69-23)														**
^{295}Og	201370#	660#				680	ms	540			16Ho09	TD	2006	α≈100	*
*^{295}Og	T : symmetrized from 16Ho09=181(+866-83)														**